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Mandrel Press.

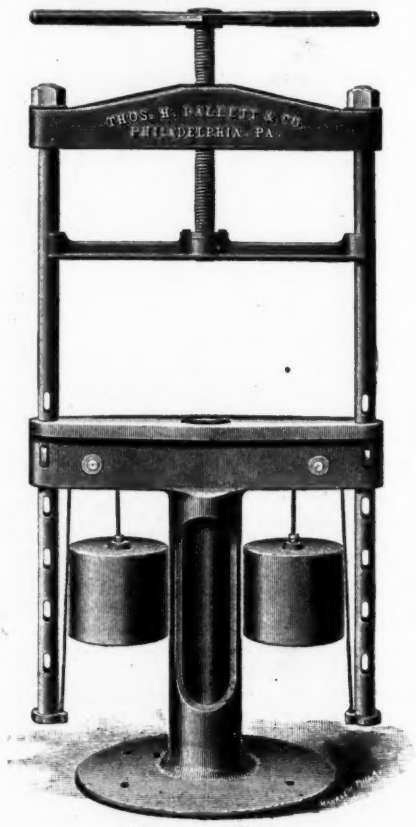
There are well-known objections to the ordinary practice of driving mandrels into and out of work with a hammer or pounding block, on account of the injury done to the work and tool. The use of a mandrel forcing press in a shop not only increases the life of the mandrels used, but also increases the amount and improves the quality of the work turned out, by reducing the liability of breakage, and insuring better fits and truer work when finished.

The illustration on this page shows a machine intended to serve this purpose. As will be seen from the accompanying illustration, it is designed to take a large range of work with simple and easy adjustments, having no loose or complicated parts liable to be mislaid or get out of order.

For ordinary work, the adjustment of the screw (12 inches) will probably be all that is necessary; but for larger or smaller work the head can be readily raised or lowered by removing the keys in uprights at ends of table, the moving parts being counterbalanced so that this adjustment can be made quickly and easily.

The distance between uprights is 22 inches; range of forcing head above table, three to 30 inches; height of table from floor, 28 inches; size of hole in table, four inches; range of screw, 12 inches.

The makers are Thos. H. Dallett & Co., Philadelphia, Pa.



MANDREL PRESS.

Sixteen-Inch Turret Chucking Machine.

This machine was originally designed for chucking, boring and reaming holes, which work it will do very much better and faster than can be done on lathes formerly used for this purpose. It is also adapted for manufacturing parts of machinery of circular cross section, and regular or irregular outline, when fitted with the necessary tools.

A number of these machines are in use for finishing pieces cast or forged approximately to shape, and also for working out pieces from cast or forged stock.

The driving belt is 3½ inches wide and the cone has three grades, the largest diameter being 10 inches. The back gears are proportioned to give a regular increase of speeds, from slowest to quickest, and can be thrown out of gear when not wanted, in the same manner as in any ordinary lathe.

The head is also provided with a patented friction clutch inside of the cone, which is operated by the handle shown in the engraving in front of the head. By means of this handle, the back gears and cone can be thrown instantly into or out of connection with the spindle, enabling the workman to operate on large or small diameters on the same piece of work, without the trouble and loss of time usually taken in shipping the belt.

The bearings of the spindle are of ample size, and run in babbitt-lined boxes.

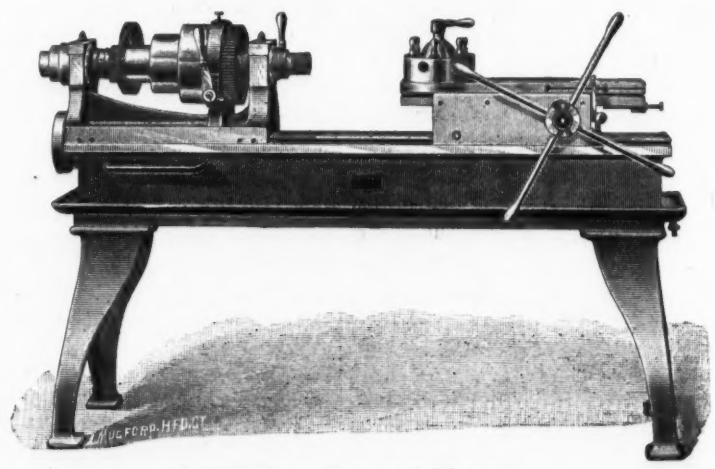
The patterns are so arranged that the machine can be constructed with three different sizes of holes through the spindle, the regular machine having a $1\frac{5}{16}$″ hole, taking 1¼″ stock. This spindle can also be fitted with a draw back collet, operated by a nut and hand wheel on the rear end of the spindle, and when so fitted it will take $1\frac{5}{16}$ stock through the collet. A special No. 1 friction head has 1⅜″ hole through the spindle, and will take $1\frac{15}{16}$″ stock through draw back collet. A special No. 2 friction head has $2\frac{7}{16}$″ hole through the spindle, and will take 2″ stock through draw back collet.

The turret is 7¼″ in diameter, and is provided with six holes for holding tools. The centers of these holes being 2¼″ above the top of the slide carrying the turret, allowing tools of 4⅜″ in diameter to swing clear of the slide.

The traverse of the slide allows a hole of 6¾″ in depth to be bored, and the tools to revolve clear of the work. A stop for gauging the depth of holes is attached to the rear end of the slide. Automatic feed and stop motion can be applied to the turret slide when so ordered, as shown in the engraving. Weight about 1,000 pounds.

A countershaft is provided with 12″ by 4½″ friction pulleys, which should make 150 to 192 revolutions per minute for the ordinary class of chucking work.

The machine is built by The Pratt & Whitney Co., Hartford, Conn.



TURRET-HEAD CHUCKING MACHINE.

Discussion of Papers at the Nashville Meeting of the American Society of Mechanical Engineers.

F. W. Dean presented a paper on "The Distribution of Steam in the Strong Locomotive," in which he made comparisons unfavorable to the Stevenson link, and practically condemned the use of balanced valves. He made comparisons of diagrams taken from locomotives fitted with the Strong gear, and those taken from locomotives with the link motion, the comparisons being favorable to the Strong valve gear. He also gave tables of the economic performance of the Strong locomotive. Among other comparisons he made was one with locomotive 129, of the Boston and Albany R. R., using for the comparison data published by Geo. M. Barrus, who tested 129 two or three years ago.

In discussing this paper, Mr. Barrus thought Mr. Dean inclined to overestimate the advantages of a four-valve engine as compared with the Stevenson link motion. He referred to the diagrams taken from the Strong locomotive, and to those taken by him (Mr. Barrus) from 129. Neither set of diagrams corresponded very closely to the ideal perfect diagram. In both instances there was wire-drawing before cut-off, early release, early compression and high back-pressure. Except in the matter of wire-drawing the Strong diagram came nearest the ideal. Taking the whole together, the diagrams from the Boston and Albany engine have the more pleasing effect on the eye. The comparison, however, did not amount to much.

The comparisons, Mr. Barrus continued, were not fair, in which Mr. Dean had shown the area of diagrams from the Strong locomotive to exceed the area of diagrams from the Boston and Albany locomotive, because the point of cut-off on the Boston and Albany engine was much the shorter. Had the cut-off been equal the areas would have been substantially the same. Mr. Barrus then made comparisons of a diagram from each engine, in which the cut-off was substantially equal, and said the Boston and Albany diagram showed the highest mean effective pressure.

Mr. Barrus referred to one of Mr. Dean's tables, in which the steam, by indicator, was given at release as 21.3 pounds per indicated horse-power per hour. This was with steam pressure of 170 pounds, and a mean effective pressure of 58.9 pounds. On the Boston and Albany locomotive, steam pressure 156 pounds and mean effective pressure 54.4 pounds, the steam at release, per indicator, was 20.3 pounds. It appeared, he said, in the matter of economy, figured from the diagram, that the Boston and Albany locomotive, with the Stevenson link motion, was the most economical.

There appeared, Mr. Barrus said, to be some inconsistency in the figures given by Mr. Dean. In one of his tables the feed-water was given as 21.3 pounds per horse-power, and the water consumption figured from the diagram with about the same indicated horse-power is the same, viz. 21.3 pounds. Taking the average results shown by all the tests, the water consumption was 23.25 pounds per indicated horse-power per hour, and the average of all the quantities giving steam accounted for by the indicator was 22.05 pounds. We have here a ratio of steam accounted for to actual consumption of $\frac{95}{100}$. It seems from this that the loss from cylinder condensation and leakage measured in the Strong locomotive at release, was only 5 per cent. This was an unheard of performance in an engine cutting off at about one-quarter stroke. The steam accounted for at release in the Boston and Albany engine was $\frac{79}{100}$ of the actual consumption, this being at a cut-off of about one-third. This correspouds to authentic results obtained from automatic cut-off engines, but $\frac{95}{100}$ is altogether out of the question.

Taking the actual consumption of coal, Mr. Barrus said, of engine 383, with the Strong valve gear as given by Mr. Dean, it was an average of 4.24 pounds per indicated horse-power per hour, and that of the Boston and Albany engine was 3.92 pounds. The comparison as to economy of the two types of engines, even here, appeared to favor the old-fashioned engine. The comparison was not exact, because one engine used anthracite and the other bituminous coal. It was, however, suggestive.

Referring to a statement in Mr. Dean's paper to the effect that all balancing devices for valves leaked, Mr. Barrus said that the valves on the Boston and Albany engine were balanced by a very simple device, and that these valves did not permit a breath of steam to pass them when placed at mid-stroke and subjected to full boiler pressure.

Mr. Coon said the true test should be the water used; probably in the test Mr. Barrus made, a superior quality of coal was used.

Mr. Barrus called attention to the statement appearing in the paper of Mr. Dean, as follows: "The great water consumption of No. 444 [one of the locomotives fitted with the Strong valve gear] was due to excessive blowing off, and to priming, caused by a timid engineer's carrying the water too high." This statement, he said, was remarkable when, as by Mr. Dean's tables, presented in the paper, within three per cent. of all the water supplied to the boiler was accounted for by the indicator.

Mr. Coon reminded Mr. Barrus that the figures he gave were his (Mr. Barrus'), and not Mr. Coon's, to which Mr. Barrus retorted that he took his figures directly from the paper presented.

President See asked if the engine on the Lehigh Valley road, against which the Strong locomotive was tested, was known to be in good condition as to tightness and adjust-

ment of valves. This he said was very important.

Mr. Coon replied that the master mechanic was requested to give them as good an engine as he had for the test. He thought the engine had been out of the shop about two months. It was not examined with a view to seeing if the valves were tight, and in proper adjustment.

In discussing John T. Hawkins' paper, "A Plea for the Printing Press in Mechanical Engineering Schools," an abstract of which we published in our May 19 issue, Mr. Kent thought the plea very good indeed, but said there was dearth of information on the subject. There were no text books for the use of the schools, and the same was true of many other subjects that schools would like to take up.

Other speakers said that manufacturers of printing presses would not permit students, nor others, to visit their works, as the builders of steam engines and other machines and machinery would.

Mr. Hutton thought that another reason why the printing press was not studied in technical schools was lack of time. A good deal must be done in four years, and the students had no preliminary knowledge of the printing press, while they generally had a fair knowledge of the steam engine.

Finally, Prof. Sweet astonished the members who had been discussing why the printing press did not find room in technical schools, and those who had been listening to these discussions, by saying that while he was at Cornell University they had one large and two small presses, and studied and used them to advantage, but since that time they had been thrown out.

Mr. Hawkins also presented another paper relating to heating by hot water, an abstract of which we published at the time noted above.

There was considerable argument against the use of hot water, the liability of leakage being strongly urged. It was also claimed that the heat, when hot water was used, was not so easily controlled as when steam was the medium. In discussing this paper, the curious fact appeared to be brought out that nine-tenths of the heating in Montreal, where the climate is very severe, is done by hot water, and about three-fourths of the heating in Washington, where the climate is very mild. The suggestion was made that perhaps the reason for this was that in Montreal there was no danger of pipes freezing, the weather being so cold that circulation was sure to be kept up, while in Washington the weather was so warm that there was no danger of freezing. Between these two extremes the danger of freezing lay, and for this reason hot water heating did not find favor in such localities.

In discussing the paper presented by L. S. Randolph, on Strains in Locomotive Boilers (for abstract see our issue of May 19), Mr. Middleton, of the Louisville and Nashville Railroad, said that the use of the Belpaire boiler did away, to a large extent, with the breaking of stay bolts.

The discussion brought out the fact that the upper stay bolts were the ones usually broken, and this was attributed to the expansion being from the bottom up, hence there was more bending of the upper bolts. This constant bending back and forth finally broke the bolts.

The fact having been brought out that the broken bolts showed crystalline structure, Mr. Kent thought this went a good way in settling the point as to whether or not iron did ever assume crystalline structure from repeated bending or shock. This was a disputed point with engineers.

In discussing the paper, "The Effect of Circulation in Steam Boilers on the Quality of the Steam" (AMERICAN MACHINIST, May 19), Mr. Whitaker instanced a similar case of priming of the boilers of the U. S. steamship Galena. The priming in this case was stopped by removing some of the tubes under the smoke stack, and substituting bolts.

Mr. Nagle thought the priming would not have occurred in the boiler referred to by Mr. Barrus if it had been longer, say eight instead of four feet.

Other speakers thought the priming was due to shortness of boiler, but Mr. Minot reminded them that in the boilers of steam fire engines the tubes were sometimes no more than 11 inches in length.

During the discussion of a paper on "Origin and Nature of the Surface Condenser," Secretary Hutton exhibited some brass tubes used for condensing the vapors in refining sugar, which appeared to show that the vapors had destroyed the zinc in the metal, eating the tubes entirely through in spots.

Mr. Nagle said this vapor was destructive to all brass wherever it came in contact with it.

NOTES.

The cars in which the Eastern members of the Society of Mechanical Engineers traveled to Nashville were held at Cincinnati from one to eight o'clock P. M. Knowing this, Mr. Doane, Mr. Gray and Mr. Jones, three Cincinnati members, met the detained members with carriages and gave them a pleasant drive over the city, stopping at the most prominent and noteworthy places, such as the Exposition Buildings, the Museum of Fine Arts, etc. The drive was thoroughly appreciated by every one.

Two of the most pleasant visits of the Mechanical Engineers at Nashville, were those to the Fisk University and the Vanderbilt University. At the former, they had the pleasure of listening to an address by President Cravath, explanatory of the aims of the institution. President See and Prof. Woodward responded briefly. But the peculiar pleasure of the occasion was the "jubilee" singing by the students. This lasted for some time, and finally the mistake was made of trying to sing the engineers out of the chapel. It was a failure. They lingered—and no wonder—as long as the singing lasted. The buildings of this institution are well adapted to their purpose, and the corner-stone of a new building, devoted in part to mechanical engineering, has just been laid.

The Vanderbilt University, in its buildings and grounds, is one of the finest in the country. The visiting engineers were cordially received, and shown through the various departments, and participated in the ceremonies of laying the corner-stone of the building for mechanical engineering, now being erected. Secretary Hutton and Wm. Kent made addresses upon the occasion.

At West Nashville, Tenn., the visiting engineers were shown over the works of the Standard Charcoal, Iron, and Chemical Co. Two blast furnaces are about completed, in one of which it is proposed to use charcoal as fuel, and in the other coke will probably be used. A large number of furnaces have been built for making charcoal according to modern practice, which is said to produce 50 bushels of coal from a cord of wood, instead of 35, as by the old process. At the same time the by-products are utilized, realizing, it is said, from the cord of wood, two and one-half to three gallons of wood alcohol, four to five gallons of tar, and acetic acid enough to make 175 pounds of acetate of lime. In connection with these processes a pump is in place that is capable of pumping from the river, some hundreds of feet almost directly below, 2,000 gallons of water per minute.

The work being done here appears to be excellent. As Gen. Warren, the president of the company, told the visitors, the company mean competition in the matter of producing iron. Excellent ore and coal are distant only a few miles.

Reference has been made to the tendency towards excursions. In addition to those already referred to, the visiting engineers were most hospitably received by General Jackson at the Belle Meade stock farm, near Nashville, and were given the opportunity to study the mechanics of some of the finest horses and cattle in the world, as well as to note the motions of nearly one hundred deer, wild enough for all practical purposes. Other places of interest in Nashville and vicinity were visited, a delegation of citizens acting as escorts.

In the visit to South Pittsburg and Chattanooga the members were chaperoned by citizens of the two places named, as well as by a delegation which accompanied them from Nashville. The journey was made in a special train.

At South Pittsburg the blast furnaces of the Tennessee Coal, Iron and R. R. Co. were visited. The company have three stacks all in operation, with a capacity of 300 tons per day. The iron is mined near the furnaces, and the coal is close at hand.

The Perry Stove Works at this place were also visited. This company has five acres under roof, and use local iron and coke. The capacity of the works is said to be 60,000 stoves a year.

The South Pittsburg Pipe Works are melting 35 tons of iron a day, using also local iron and coke.

There are also at South Pittsburg agricultural implement works, large saw and planing mills, brick and terra-cotta works, etc.

At Chattanooga the chief interest centered in the excursion to Mission Ridge and Lookout Mountain. These places are reached by a very complete system of railways, with which Chattanooga is excellently provided. There was but little time to visit manufacturing works, but at a meeting in the evening, between the Board of Commerce, citizens and visiting engineers, considerable information as to manufactories already established, and the facilities for establishing others, was furnished.

The secretary reported at the Nashville meeting of Mechanical Engineers that there were received during the past year 45 members, 2 associates and 11 junior members, making a total membership of 858.

A Device for the Tool Room.

It is sometimes no easy matter, in shops employing a considerable number of men, to properly arrange the matter of the distribution of supplies, such as files, oil, waste, etc., so that each man may have all of such things needed for his work, and yet no one be given an opportunity to waste them. In some shops, every one is allowed to help himself to such things as often and as liberally as he chooses, without any restrictions whatever, which is one way, and, perhaps, a good enough way, where there is a surplus of cash which must be gotten rid of. Another way is to give to each man a certain quantity of waste (for instance) each week, and expect him to get through with it, and to use that amount, and no more. That is a poor way, because the amount of waste required by a workman will depend very much upon the kind of work he is doing, and one man may actually need twice as much as another, and in shops where this plan is pursued it is quite common to find one man suffering for waste, while the one next to him may have the bed of his lathe, under the board, full of it; that is, provided the first man has sufficient respect for "vested rights" to let it remain there. Another plan, followed in too many shops, is to see to it that no one has enough of anything, thereby making sure that no one has too much; and that is the worst plan of all. Where such supplies are kept in the tool-room, or some place specially provided for them, as, of course, they should be, the man who hands them out on demand is usually depended upon to spot the extravagant fellows; but since, in a large shop, he can seldom be acquainted with the requirements in each case, this often leads to trouble.

We saw a piece of tool-room furniture in the tool room of the Brown & Sharpe M'f'g Co. recently, which solved this problem in a very satisfactory manner. It stood on the bench just inside the window, and reminded one of a revolving book case, only it was much smaller and had no shelves, but instead, a great many little brass hooks all over the outside, on each of which hung a set of brass checks numbered alike, and each set being devoted to one man, the number stamped on the checks corresponding to the number of his regular tool checks. The inside of the cylinder was divided into compartments by vertical partitions, which were labeled with the names of the various articles called for. A man calling for waste would be given a certain amount of it, and that certain amount would be given to him as often as he might choose to call for it; but each time, one of his checks would be taken off the hook on the cylinder and dropped through an opening into the compartment labeled waste; so with any other article.

Now at definite times these compartments are opened, and the number of times any one has obtained any given article, since the last examination, is indicated by the number of his checks which are found in the compartment which is labeled with the name of that article, and thus comparisons may be made, and those in charge of the departments, or others whose business it is to attend to such things, may know just who is using the greatest quantity of any of the supplies, and why.

We have seen a good many shops where such a thing would be appreciated after a trial; it is a good thing for the men as well as for the proprietors, because it helps to discriminate between the careless men and those who are not careless, and would naturally tend to liberality in the matter of supplies, born of the conviction that they were being used to good purpose, and not wasted.

Another reminder that the slow moving planer may become an instrument of death, though it appears to be so harmless, is in the death of Thomas Scott, at Dialogue's shipyards, Camden, N. J., May 8. His head was caught between a bed-plate, which he was planing, and the housing, and was completely severed from his body.

A correspondent writes us to the effect that it would be a convenience if correspondents would always give their full name, to the end that others might write direct to them, in relation to matters of interest. As a general thing we think correspondents do well to write over their names, but there are instances where this is not advisable. We can generally put anyone desiring it in the way of communicating with an anonymous correspondent, as we publish no communications unless we know the name and address of the writer.

Practical Drawing.

BY J. G. A. MEYER.

FIFTY-FIRST PAPER.

PROBLEM 66.

458. *To find the intersection of a surface of revolution and a given plane.*

Let Fig. 343 represent the vertical, and Fig. 344 the horizontal projection of a solid; and $g_2\ k_2$ the horizontal projection of a given plane passed through this solid; the given plane is to be, as the line $g_2\ k_2$ indicates, parallel to the vertical plane of projection; it is required to find the lines of intersection of the plane and the surface of the solid.

This surface, Fig. 343, is made up by the single curved surfaces $h\ a\ h_3\ a_3$, and $e\ f\ e_3\ f_3$, and also by the double curved surface $a\ c\ e\ a_3\ c_3\ e_3$; or, in other words, this surface of revolution is generated by the straight lines $h\ a$ and $e\ f$, and the arc $a\ c\ e$, all revolving around the axis $x\ y$.

The arc $a\ c\ e$ is described from the center m, and is tangent to the line $h\ a$. The circle $a_6\ a_8\ a_{10}\ a_{12}$, in Fig. 344, represents the base of the upper cylinder $h\ a\ h_3\ a_3$, and consequently the diameter $a_8\ a_{10}$ is equal to $h\ h_3$; the circle $e_2\ e_4\ e_6\ e_8$ represents the base of the lower cylinder, and consequently the diameter $e_2\ e_6$ is equal to $e\ e_3$. Let $A\ B$ be the ground line.

In Fig. 344 it will be seen that the distance $y_2\ a_6$ from the center y_2 to the given plane is equal to $h\ y$, which is one-half the diameter $h\ h_3$ of the cylindrical surface $h\ a\ h_3\ a_3$. Consequently, to find the highest point of the curves of intersection we draw a horizontal line through the center m, cutting the straight lines $a\ h$ and $a_3\ h_3$ in the points a and a_3; and also cutting the line $x\ y$ in the point a_5. This point a_5 will be the highest point of the curves of intersection; or we may say that the curves of intersection will meet and terminate in the point a_5. Divide the arc $a\ c\ e$ into any number of equal parts, say four, and through the points of division b, c, d, draw the horizontal lines $b\ b_3$, $c\ c_3$, $d\ d_3$ terminating in the arc $a_3\ c_3\ e_3$.

From the center y_2 (Fig. 344) describe three circles $b_2\ b_4\ b_6$, $c_2\ c_4\ c_6$, and $d_2\ d_4\ d_6$, whose diameters are equal to the lines $b\ b_3$, $c\ c_3$ and $d\ d_3$ respectively. The circle $b_2\ b_4\ b_6$ cuts the line $g_2\ k_2$ in the points b_2, b_6; the circle $c_2\ c_4\ c_6$ cuts the line $g_2\ k_2$ in the points c_2, c_6; and the circle $d_2\ d_4\ d_6$ cuts the line $g_2\ k_2$ in the points d_2, d_6. Through the points b_2, c_2, d_2 draw the vertical lines, the first cutting the horizontal line $b\ b_3$ in the point b_5; the second cutting the line $c\ c_3$ in the point c_5; and the third cutting the line $d\ d_3$ in the point d_5. Through the point g_2, in which the cutting plane cuts the circumference $e_2\ e_4\ e_6\ e_8$, draw a vertical line cutting the line $e\ e_3$ in the point g, and the line $f\ f_3$ in the point i; the line $g\ i$ will be the line in which the cutting plane intersects the cylindrical surface $e\ e_3\ f\ f_3$. Join the points g, d_5, c_5, b_5, a_5 by a curved line; this curve will be one of the curves of intersection of the double curved surface $a\ c\ e\ a_3\ c_3\ e_3$ and the given plane. In a manner precisely similar to the foregoing, the lines of intersection on the other side of the line $x\ y$ are found.

Now let us examine the principles upon which this construction is based. Since the arc $a\ c\ e$ is tangent to the line $a\ h$, the point of tangency is found by drawing through the center m a line $m\ a$ perpendicular to $h\ a$ (see Art. 144), the point a, in which $m\ a$ cuts the line $h\ a$, will be the point of tangency, or the point of contact. Hence we may say that the point a is the junction of the line $h\ a$ and the arc $a\ c\ e$; we may also conclude, and correctly, too, that the horizontal line $a\ a_3$, drawn through the point of tangency, represents the junction of the single curved surface $h\ a\ h_3\ a_3$, and the double curved surface $a\ c\ e\ a_3\ c_3\ e_3$; that is to say, the double curved surface extends up to the line $a\ a_3$, and at this same line the single curved surface commences.

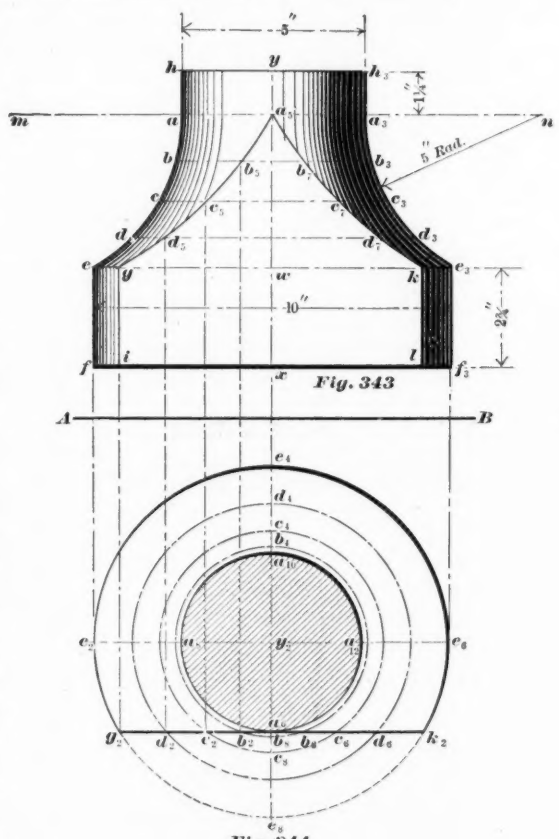


Fig. 343

Fig. 344

Now observe, in Fig. 344, the distance $y_2\ a_6$ between the center y_2 and the given cutting plane $g_2\ k_2$ is equal to $h\ y$, which is one-half the diameter $h\ h_3$ of the upper cylindrical surface. Consequently the given cutting plane $g_2\ k_2$ must be tangent to the cylindrical surface $h\ a\ h_3\ a_3$; and, indeed, this is clearly shown in Fig. 344 by the line $g_2\ k_2$ being tangent to the circle $a_6\ a_8\ a_{10}\ a_{12}$, which is the horizontal projection of the base of the cylinder $h\ a\ h_3\ a_3$. The line $y_2\ a_6$ drawn through the center y_2 is perpendicular to the line $g_2\ k_2$, consequently the point a_6, in which $y_2\ a_6$ cuts the line $g_2\ k_2$, must be the point of tangency of the line $g_2\ k_2$, and the circle $a_6\ a_8\ a_{10}\ a_{12}$. When a plane is tangent to a cylindrical surface it will touch the surface in one of its elements, and this element will contain the point represented by a_6 in Fig. 344, consequently the line $a_5\ y$ (Fig. 343), which is part of the vertical line drawn through a_6, must be the vertical projection of this element of contact; and since this element of contact cannot extend beyond the cylindrical surface $h\ a\ h_3\ a_3$, it follows that the point a_5, in which the vertical line through the point a_6, cuts the line $a\ a_3$ must represent the lower limit of the element of contact. Again because the given cutting plane is tangent to the cylindrical surface $h\ a\ h_3\ a$, the cutting plane must intersect the double curved surface $a\ c\ e\ a_3\ c_3\ e_3$ throughout its whole height, from the line $e\ e_3$ to the line $a\ a_3$. But the line $a\ a_3$ is the junction of the single and double curved surface, therefore the point a_5, which lies in the line $a\ a_3$, will not only represent the extremity of the element of contact in the cylindrical surface, but the same point will also represent the beginning and the highest point of the curves of intersection.

The line $b\ b_3$ we may consider to represent an auxiliary plane perpendicular to the vertical plane of projection, and passed through our solid. This auxiliary plane will intersect the double curved surface in the circumference of a circle whose diameter is equal to the length of the line $b\ b_3$. The horizontal projection of this circumference is represented in Fig. 344 by that of the circle $b_2\ b_4\ b_6$. In this figure it is seen that the given cutting plane cuts off from the circumference a small arc $b_2\ b_8\ b_6$; the extremities of this arc are the points b, b_6, in which the line $g_2\ k_2$ cuts the circumference. The vertical projections of these extremities must lie in the line $b\ b_3$ (Fig. 343) because the line $b\ b_3$ and the circumference $b_2\ b_4\ b_6$ are the projections of one and the same circle, consequently the point b_5, in which the vertical line through b_2 cuts the line $b\ b_3$, is the vertical projection of one extremity of the arc which has been cut off, and for a similar reason the point b_7 is the vertical projection of the other extremity of the same arc. Now because the cutting plane, and also the double curved surface, contain these points b_5, b_7, these points must also lie in the curve of intersection. Similar reasoning applies to the other points c_5, c_7, d_5, d_7, and consequently the curved line, which contains the points $a_5\ b_5\ c_5\ d_5\ g$, and the curved line which contains the points $a_5\ b_7\ c_7\ d_7\ k$, must be the intersection of the double curved surface and the given plane. Therefore the curves $a_5\ c_5\ g$, $a_5\ c_7\ k$, and the straight lines $g\ i$ and $k\ l$ represent the intersection of the surface of the solid and the given plane.

459. This method of finding the intersections of solids and planes is applicable to the solution of various problems, and is an important one in practical drawing; it can also be often advantageously employed for other purposes, as we shall presently show in a practical example. On account of the importance of this method of finding the lines of intersection, and its usefulness, we shall, in addition to the foregoing explanation, endeavor to impress upon the student the principles of construction by the following practical illustration:

Let Fig. 345 represent the same solid as is shown in Figs. 343 and 344. In Fig. 345 this solid is represented to be in a lathe. Now suppose that through the points a, b, c, d (whose positions on the surface of the solid correspond to the positions of the points a, b, c, d in Fig. 343), we cut tool marks on the surface of the solid as it revolves about its centers x and y. If we now stand in a certain position in the front of the lathe, these tool marks will appear to be straight lines, as shown in Fig. 345; indeed, if it had not been for the shade of the body, it would be difficult to distinguish these lines from perfect straight lines. If, on the other hand, we look at our solid endwise, in a direction as indicated by the arrow, then these tool marks will appear as circumferences of circles, which is their true form. Assume now that with the aid of a saw we cut from the solid a

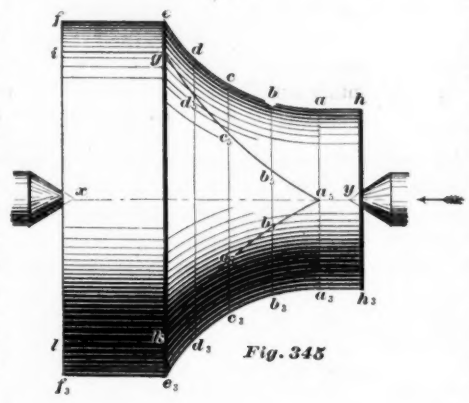


Fig. 345

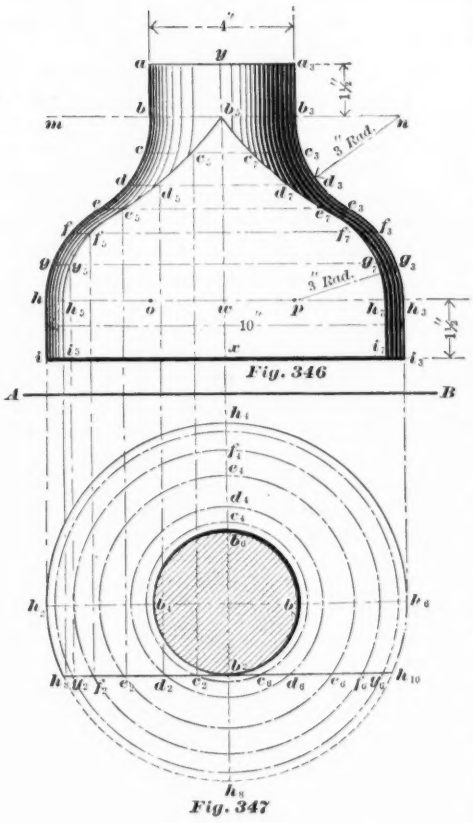


Fig. 346

Fig. 347

be perceived that in order to find the curves which limit the extent of the cut we have only to find the extremities b_5, b_7, c_5 c_7, etc., of the tool marks and join these points by curves; and this is precisely what we have done in Fig. 343.

460. It must also be remarked that instead of dividing the arc $a\ c\ e$ into equal parts, we may divide the straight line $a_5\ w$ (Fig. 343) into equal parts, and then draw horizontal lines through the points of divisions, terminating in the arcs $a\ c\ e$ and $a_3\ c_3\ e_3$ as before; or, for that matter, we need not divide the arcs or the straight line $a_5\ w$ into equal parts, but place the lines $b\ b_3$ $c\ c_3$, etc., in any position we please; the result will be the same so long as we draw these lines of division horizontally, and make the diameters of the corresponding circles in the horizontal projection (Fig. 344) equal to the length of the lines of division; of course the lengths of these lines are always limited by the arcs $a\ c\ e$ and $a_3\ c_3\ e_3$.

461. When great accuracy is required, the arc $a\ c\ e$, or the straight line $a_5\ w$, must be divided into a greater number of parts; the greater the number, the greater the accuracy.

Directions.—In the space marked Prob. 66, draw the vertical and horizontal projections of the solid, having the same form and the same size as that given in Fig. 343; then find the intersection of the surface of this solid and a plane placed 2½ inches from the center line $e_3\ e_4$, as shown in Fig. 344. Use a 3 inch scale.

PROBLEM 67.

462. *Another case. To find the intersection of a surface of revolution and a plane.*

Let Fig. 346 represent the vertical, and Fig. 347 the horizontal projection of a solid; $h_8\ h_{10}$ the given cutting plane, which is parallel to the vertical plane of projection, and tangent to the circle $b_2\ b_4\ b_6\ b_8$; $A\ B$ the ground line; it is required to find the intersection of the surface of the solid and the given plane.

This problem is simply a combination of Problems 65 and 66, and therefore in regards to its solution little need to be said.

We may consider that the surface of this solid is generated by the straight lines $a\ b$, $h\ i$, and the arcs $b\ d\ e$ and $e\ f\ h$, or we may say that the straight lines $a\ b\ h\ i$ and the arcs $b\ d\ e\ e\ f\ h$ make up or form the generatrix. Consequently our surface of revolution consists of three parts, namely, the single curved surface $a\ b\ a_3\ b_3$, the single curved surface $h\ i\ h_3\ i_3$, and the double curved surface $b\ e\ i\ g\ b_3\ e_3\ g_3$. The arc $b\ d\ e$ is described from the center m, and therefore a horizontal line, $m\ b_3$, drawn through the center m, will be the junction of the single curved, or cylindrical surface $a\ b\ a_3\ b_3$ and the double curved surface; the arc $e\ f\ h$ is described from the center o, and therefore the horizontal line $h\ h_3$ drawn through the center o will be the junction of the double curved surface and single curved, or cylindrical surface $h\ i\ h_3\ i_3$. Divide the curved line $b\ e\ h$, or the straight line $b_5\ w$, into any number of equal parts; through the points of division draw horizontal lines, such as $c\ c_3$, $d\ d_3$, etc., then find points c_5, d_5, etc., in the curve of intersection in a manner precisely similar to that adopted in the last two problems; in fact, the whole construction is plainly shown in the figures. The curved lines drawn through these points and the straight lines $h_5\ i_5$, $h_7\ i_7$ will complete the problem.

Directions.—In the space marked Problem 67 draw the vertical and horizontal projection of a solid whose size and form are the same as those shown in Fig. 346. Place the cutting plane in a similar position to that of the plane $h_8\ h_{10}$ shown in Fig. 347, and find the intersection of the surface of the solid and the given plane. Use a 3-inch scale.

Something About Reamers.

By Frank H. Richards.

The shop well supplied with small tools, in good condition and always readily accessible, has a great advantage over the shop not so equipped, and any one having the direction of a machine shop, and its well being at heart, should see to it that such tools are provided—good tools in generous variety, well used and well kept. There are those—not generally practical machinists themselves—who in equipping a shop will buy the best of large tools, lathes, planers, drills, etc., and then think their duty done, and expect to see good and abundant work turned out. They don't see it. It is not much exaggeration to say that, in a machine shop for general work, the cost of the small tools should be as great as that of the large. In this, as in everything else, the big shop has the advantage over the little one, the relative cost being less in the former, because the same tools may be used by so many different hands.

Frequently machine shops come to an end, and are sold out, and you see catalogues of their machinery and you seldom see any mention of small tools. The fact usually is that the small tools do not exist. The shop has not had the modern means, nor the modern methods that accompany them, and so has come to grief, as it ought to. The prosperous shops, of course, are better supplied, and would make a more various catalogue.

Now, when it comes to the getting of the tools it is not a fair statement of the whole subject to say that small tools, reamers, for instance, can be made better and cheaper in factories specially equipped for that purpose, and that, therefore, you should buy instead of making them. There are few shops where all the men can always be most advantageously employed. If the shop be ever so busy all cannot be carried along evenly, and some must sometimes be slack. Advantage of these slack spots may be taken to make up or repair necessary articles, and many conveniences, if not made in this way, will not be got at all. It is not the question whether to buy or to make the article; but whether to make it or go without it. When it comes to that there is but one answer; and so if you can't buy reamers, make them. Make them when you can, make them as well as you can, and if those who have made them can offer any points, don't despise them, but improve upon them all you can. No better appreciation of a good thing can be shown than by suggestions of improvement. Nobody ever improves a worthless article. It is your veritable stick-in-the mud, when stuck in the mud, who will not thank you for showing him more solid ground near by, but will challenge you to argue with him that he is not standing in the very best place he could possibly stand.

The worst thing about home-made small tools is that usually there is not enough system followed in their production. We come to a place where we must have some tool for a special job, and we make it in size and proportion as best adapted to that particular case. In a few days we want another size for another job, and we find an odd piece of steel which will work in and make a tool that will satisfy the emergency, but the last made tool is far from corresponding in proportion with the earlier one. Additions to the collection by the same no-system make it still more incongruous. By and by, when we realize the convenience of these things, and undertake to complete the series, we begin to appreciate the result of our lack of foresight. With this appreciation will naturally come the remedy, and the sooner it comes the more valuable will be the series of home-made tools produced.

If we undertake to make reamers I do not know anything better than to follow the practice of the best makers. Their lengths and proportions are generally good, although I think that shell reamers are usually too short. The cutting face should be radial. The shape of the flute should be a continuous curve, with no sharp angle to invite a crack in hardening. The bearing faces should be narrow. There should be very little clearance from the circle, but that little is necessary. With no clearance the dust will pack upon the face and make the hole rough, and the reamer will pull hard. With much clearance the reamer has more chance to chatter, and the cutting edge will wear away fast and the reamer rapidly lose its size. For brass or bronze the reamer should have more clearance, and should be as hard as possible.

Chattering is always a nuisance; it probably causes as much trouble in the machine shop as anywhere, and a chattering reamer is among the worst of its exhibitions and should not be tolerated. Cutting the flutes spirally does not necessarily tend to prevent chattering, and is only of any practical value when there are longitudinal slots in the hole to be reamed. An irregular spacing of the flutes undoubtedly does help the matter, and should always be adopted. The difference of spacing is none the better for being excessive. If we have a reamer factory and put our drummer on the road to talk up the goods as loudly as possible, it may be well to make the difference enough to be readily visible so that he, waxing eloquent, may hold it up and say "Behold!" but the minute differentiation of what I may call a regular irregularity, making the spacing of each flute slightly different from that of every other, covers all the possibilities of the case.

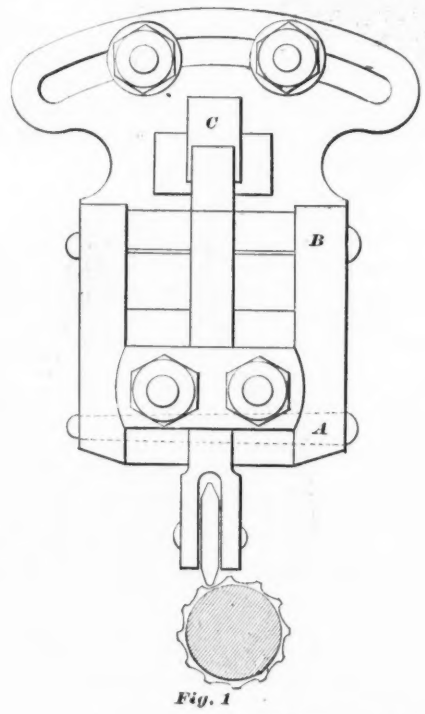


Fig. 1

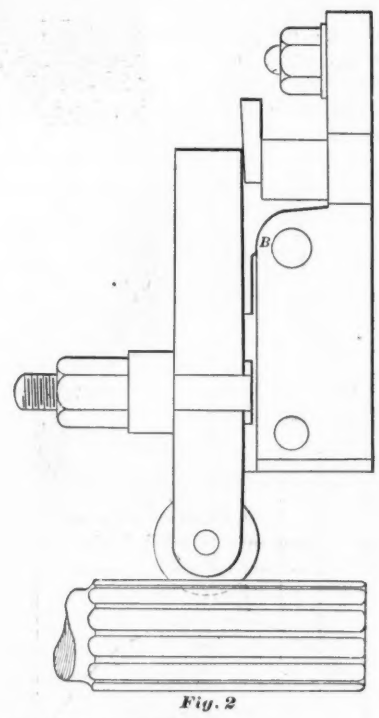


Fig. 2

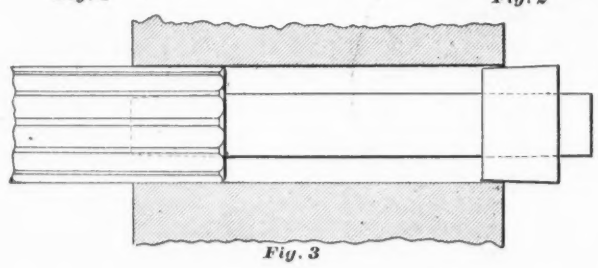


Fig. 3

Here we have a $1\frac{1}{4}''$ reamer in which I wish to cut 13 flutes. The dividing head upon the milling machine has a worm wheel with 40 teeth. To divide 40 by 13 we must turn the worm $\frac{40}{13}$ or $3\frac{1}{13}$ times. We use an index circle of 39 holes, and the normal movement required will be 3 turns and 3 holes. We then make a list of the series of 13 movements required to complete a revolution of the reamer, taking this 3 turns and 3 holes for the central one of the series, and increasing by one hole upon one side and decreasing by one hole, upon the other, until the total number of 13 flutes or movements is provided for. The list will then be like this:

	Turns.	Holes.		Turns.	Holes.
1	2	36	8	3	4
2	2	37	9	3	5
3	2	38	10	3	6
4	3	0	11	3	7
5	3	1	12	3	8
6	3	2	13	3	9
7	3	3			

Upon our $1\frac{1}{4}''$ reamer with 13 flutes cut by this list, the smallest flute would measure the space from one cutting face to the next .289", the largest flute would measure .317". The difference between each flute and the next would be .0025". The smallest number of corrugations or chatters in the circle that could coincide with all the teeth, and so make chattering possible, would be 1,560.

If we wished to cut an even number of flutes there would, of course, be no central one for our list, and we would make the two nearest the center alike. Thus to cut 14 flutes we would use a 42 circle and the normal movement would be 2 turns and 36 holes, and our list would be:

	Turns.	Holes.		Turns.	Holes.
1	2	30	8	2	36
2	2	31	9	2	37
3	2	32	10	2	38
4	2	33	11	2	39
5	2	34	12	2	40
6	2	35	13	2	41
7	2	36	14	3	0

In cutting our reamer we would naturally begin at the top of the list; before cutting the first flute, seeing that all the slack or lost motion is taken up in the direction we propose to turn. When all the movements have been used the revolution is completed, and the reamer is brought around to the starting point, and if we wish to go around again we begin anew at the top of the list. We mill the reamer backward, that is, after one flute is cut we mill next the flute behind it, and then we can see how deep the cutter should be set to leave the required thickness at the cutting edge. The depth must increase a little with the increase in the spacing.

Of course reamers, like everything else, will wear. When they are much used the wear will soon cause serious trouble; and to maintain a standard size, or a satisfactory approximation to it, will require watchfulness and decision. The allowed limit of wear should be established by placing two collars of different sizes in the tool room, the larger for the beginning size, and the reamer to be retired or restored when it gets down to the smaller size. The difference to be permitted would vary with the shop and its line of work. In some shops .001" would be enough. The average shop would be contented and happy if it could keep the limit within .005". I am inclined to think that two sizes of reamers would be found useful, the larger for loose fits, the smaller for tight ones, and when the reamer has done service for the larger it may be reground and used for the smaller. I believe our ancient friend Chordal, and others, have insisted that the size of the reamer should be maintained and the difference of fit made in the turned shaft, which is good practice for the better class of work; but for the general work of to-day, where so much factory-made shafting is used, and where that shafting is produced with so great accuracy of size as it now is by the best makers, the two reamer sizes will save a great deal of trouble.

It seems sensible to assume that the more a reamer has to cut the more it will wear, and the way to save it and maintain its size as close as possible is to leave as little as possible for it to cut. The reamer with the patent screw upon the ends of the teeth to feed it through the hole, is, in my opinion, a mistake, because it assumes that the reamer is to have what I should call a heavy cut where it should have, in the interest of its longevity, a light one. Certainly if I wished to use a reamer under what I would call most favorable conditions, I would not let it cut enough for the screw teeth to take hold of. To save the reamer and in a way insist upon having the hole in which it is to be used bored as perfectly and as near the size as possible, I would not taper the point of it very much. This would make it necessary to bore the hole large enough, or the reamer could not be comfortably used, and the machinist dearly loves comfort, and his instinct is correct. Where the reamer is used to follow chuck drills this would help to enforce their maintenance in good condition, and that would be a blessing.

When the reamer has worn so small that it is no longer of use, don't let it lie around long in memory of the good it has done. It should be annealed, re-turned, re-cut and finished up for a smaller size. Or the reamer can be enlarged by upsetting or swaging the teeth, and thus be brought up to its original size. I have made reamers as good as new by working up the teeth with a roller, as shown in the cut. This, I think, will require little explanation. The reamer is mounted upon the planer centers. It should usually be blocked up under, to support the pressure we have to put upon it without springing. The reamer is run back and forth under the roller a few times and the roller is fed down as hard as may seem necessary, which a little experience will determine. The roller is also moved a little sidewise one way or the other, after each stroke. Ten or twelve strokes will usually be enough.

In using this roller tool for this purpose it will of course be necessary to fasten down the tool holder. I call attention to a method of doing this. I do not know whether this "kink" has ever been in the papers; but it should certainly be known and universally adopted. Put a taper hole right through the tool holder block and the sides at *A*, and when you want to block the tool down put in the taper pin fitted to the hole and kept for the purpose, and you will hold everything down with perfect safety. Upon most planers if they have a weak spot it is likely to be at *B*. I have often seen a tool block fastened down to plane with an angular or hooked tool under a projection, by blocking or wedging behind the top of the tool as at *C*, and if anything had happened to make the tool catch, the tool block would certainly have been torn up by the roots. I must confess I never saw the accident occur, but I have often clapped my hands over my eyes and run away in shuddering horror in anticipation of such a catastrophe. Builders of planers should put in such a pin as here suggested, or provide some other safe means of fastening down the tool holder when so required.

When we look over, and admire the handsome reamers of the factories, and note their perfection in every particular, we are glad to believe that their makers know it all, and as they know it all they cannot possibly have any trouble, as we poor mortals do. For instance, when the reamer is hardened, of course, for them, it will always harden perfectly straight. For me it will not, although for reasons entirely unaccountable. I am inclined to believe steel behaves for me a little better than it used to. But still a reamer is apt to be a little crooked after hardening. When I find one so I can usually make it true enough upon the centers for grinding by altering the center in the top or wrench end of the reamer, and I leave this end of the reamer a little large, to allow for turning it true after the center has been corrected.

After tempering, the reamer can only be accurately ground to size and neatly finished upon some suitable grinding machine, and such a machine for many purposes is a necessary appendage of a well-equipped shop. I have used with satisfaction for a wide variety of grinding the Brown & Sharpe universal cutter and reamer grinder, and I can best testify my appreciation by finding fault with it. It is a tool so good and convenient that I find myself constantly wondering why it is not better than it is. The centers for holding a reamer to be ground are mounted upon a turn-table of small diameter graduated to degrees, and when set to the mark as accurately as eyesight can adjust it, its inaccuracy for straight reamer grinding is exasperating, and it is a tedious job to keep trying and adjusting the machine until it is brought to grind parallel. When next the machine is required for the same purpose the same tedious process must be gone through with.

Reamers to be used in the lathe should have a hole large and deep, fitted to a pin or parallel center instead of a conical one, and then there will be no tendency to draw in or to pry off sidewise out of line with the hole. Everybody knows this, but it is one of those things that we have to keep telling all the same, and then it is only followed sometimes.

A very desirable thing, and something seldom used or thought of, is a means of starting a reamer straight with the further end of the hole. If a shell reamer, the stem may be prolonged, and if a solid reamer it may have a taper hole in the end of it (Fig. 3), and to this hole a pin or stem may be fitted with a collar sliding easily upon it. The outside of the collar should be turned taper, to fit the hole, and when pushed into place will serve to make the reamer point central until it is far enough in to guide itself. The taper should be slight; it is purposely exaggerated in the drawing.

Compound Engines.

BY W. H. BOOTH.

SIXTH PAPER.

Reference has already been made to the great desirability of such an early cut-off in the second cylinder as shall maintain the steam pressure in the receiver between the two cylinders pretty nearly equal to the terminal pressure in the preceding cylinder, said terminal pressure being measured, of course, at the time of opening of the exhaust port—not at the end of the stroke.

In this paper we are now able to present diagrams recently taken by a friend of the writer from engines of considerable size, in which the fault of a too late low-pressure cut-off, and a correct cut-off, are illustrated. The first case is shown in the diagrams of Fig. 1. These figures, from the high-pressure cylinder of a compound beam engine, fitted with the gridiron cut-off valve of the McNaught and Varley type, have an almost perfect steam admission, and a well-defined point of cut-off, together with a regular expansion curve. The exhaust port does not open until very near to the end of the stroke, and then there is only a small drop in the pressure, showing that the receiver pressure is well maintained by a suitable low-pressure cut-off. The low-pressure diagrams are not to hand, but the rise in the high-pressure exhaust line at about the mid-stroke, or a trifle in advance of this, shows us that the low-pressure admission has ceased before the half-stroke—the engine being of the beam type, and the pistons therefore working stroke for stroke. It is probable that any earlier cut-off than is here shown to exist would not be productive of any advantage on the score of economy, though experiment alone could finally decide this point, and determine whether, in this particular case, the capacity of the exhaust passages is such as to warrant the change which the slight fall of pressure shows to be required in a limited theoretical sense. In advocating the early cut-off in the second cylinder of a compound engine for the purpose of avoiding useless expansion between the cylinders, I would not be understood to draw a hard and fast line from which neither common sense nor the teachings of experience must ever warrant a departure, for I have encountered cases where, owing to the smallness of exhaust passages, it has been found better to allow some drop in pressure, than to attain an apparently more perfect diagram; but I would insist, in new work, upon the necessity of ample passages, so that there may be no impediment to the attainment of good diagrams.

In Fig. 2 we have a very similar diagram to Fig. 1—the same good admission, cut-off and expansion, and the still less drop of pressure into the receiver. The rise in the exhaust line, after the closure of the low-pressure admission, is more marked than in the previous instance, and is likely due to a smaller receiver. In Fig. 2, also, admission is rather too early, especially as the speed is low, and as, in all beam engines compounded by the addition of a high-pressure cylinder midway on the beam between the center and the connecting-rod, the stroke is short. The effect is to spoil also the appearance of the diagram.

In contrast with the two examples given in Figs. 1 and 2, I now give the diagrams of Fig. 3—also from a beam engine compounded in the same fashion as those from which the previous diagrams were taken. These diagrams, Fig. 3, are almost perfect specimens in themselves, for the work that is being obtained from the high-pressure cylinder looked upon as a rather overloaded high-pressure engine, but as coming from the first cylinder of a compound engine, they are evidence of the faultiness of the engine as a compound whole, for there is a drop of pressure of about 15 pounds between the two cylinders. This would clearly be an example of the non-requirement of a low-pressure jacket, for the superheat due to the drop must be considerable.

One of the commonest faults met with in compound engines is that of the small cylinder doing the larger share of the work, and this fault is usually found accompanied by a heavy drop of pressure, as in Fig. 3. The remedy is obvious—correct adjustment of the valves, which may be made to equally divide the work between the two cylinders. It is a matter of common observation among experts that many builders of compound engines appear thoroughly able to supply good work as regards proportions of cylinders and passage, but seem quite unable to comprehend the method of steam distribution necessary to secure economical or even steady working. It is a great mistake to suppose that care only is required for the first cylinder, and that when the steam has finished therein it may be left to find its way to the condenser in its own way. Nothing is more erroneous; for just as the low-pressure cylinder is the measure of the capacity of the engine, so is it by far the more important of the two; and a proper degree of expansion is as important as in a simple engine, or otherwise no advantage will accrue from compound working. When indicating compound engines, it is a good plan to use such a scale of spring as shall be proportional to the capacity of the cylinders. When this is done, and an equal length of diagram obtained, it is easy to judge by a glance whether the two figures have about an equal area, as should be the case when equal power is being developed in each cylinder.

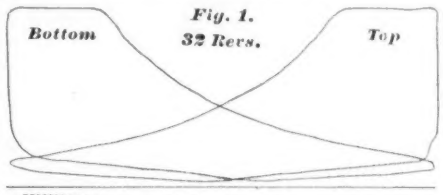


Fig. 1.
32 Revs.

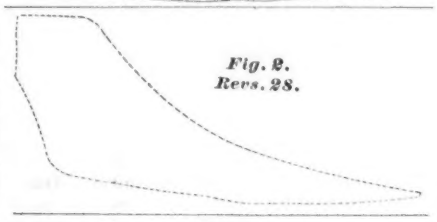


Fig. 2.
Revs. 28.

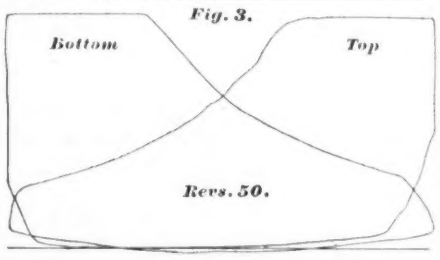
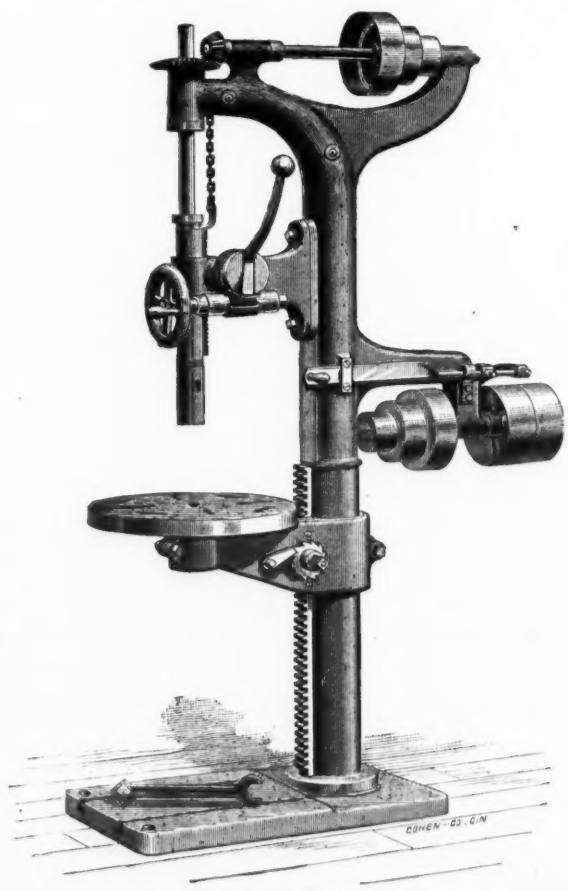


Fig. 3.
Revs. 50.

Necessarily such a balance cannot always be obtained consistent with the best results, but usually there is no necessity for such a ratio of work from the two cylinders as ½, or ⅓, or even ¼, as I have seen, and a very even division may generally be effected, especially when, as is sometimes found, a variable cut-off is attached to the large cylinder. Indeed, in all engines of fair size, the low-pressure on the gear should always be adjustable by hand, though an automatic adjustment is an unnecessary refinement, especially for engines subject to a steady load. Speaking recently with a marine engineer, formerly running out of the port of New York, upon this subject, he stated that he once sailed as second under an old-fashioned chief who ran with a casing pressure of only six pounds, though the boiler pressure was quite high. A severe thump occurred at the lower center. When my informant took his watch he began to link up the low-pressure valve, until finally he secured a casing pressure of twelve and fifteen pounds, and not only cured the heavy thump at the lower center, but eased the work of the firemen very perceptibly also. This same engineer has since been equally fortunate in reducing coal consumption by a stationary engine, simply by the intelligent use of an indicator, and carrying out alterations shown by it to be requisite.



THE BICKFORD DRILL PRESS.

It seems to be an assured fact that American tool steel is finding a market in Europe, and regular shipments are being made from Pittsburgh, competing with English tool steel in both quality and price.

The Bickford Drill Press.

We illustrate on this page a drill press, recently brought out by the Bickford Drill Co., Cincinnati, Ohio.

The cut makes the general appearance and design of the machine very plain, rendering extended description unnecessary. It is provided with a worm and wheel feed, and an improved quick-return motion, which renders it very easy and convenient to handle, and the makers state that all shafts and spindles are made of steel, and the gears are cut.

Further information may be obtained by addressing the makers as above.

An Elementary Question in Physics.

A reader, who says he is an apprentice in a machine shop, sends us an editorial bristling with italics and exclamation points, which he says he cut from one of our contemporaries, and which attacks our answer to Question 214, relating to the behavior of a cannon ball fired from a moving train. This apprentice seems to think that this editorial throws some doubt upon the correctness of our answer, and asks us to explain.

The best advice we can give this particular apprentice, and all other apprentices to the machine trade, is to procure an elementary work on Natural Philosophy, or Physics, the study of which, besides being one of the most useful occupations a young mechanic can possibly engage in, will forever prevent him from being so palpably and ludicrously mistaken on such a question as the editor of our contemporary shows himself to be.

However, for the benefit of our correspondent and others who may not be entirely clear on this question, we will suppose two persons, one at each end of a car which is standing still; suppose that they throw a ball back and forth between them, always throwing it at a speed equivalent to 60 miles an hour. As long as the car remains stationary the ball will have a speed relative to the car and the men who are throwing it, of 60 miles an hour, and it will have the same speed relative to the ground. Now suppose the car to be put in motion and to attain a speed of 30 miles per hour while the ball is still being thrown back and forth at the same velocity as before (60 miles); it will then be evident that, although the ball will have exactly the same motion and speed relative to the car and the men who are throwing and catching it, yet relative to the ground, it will, when thrown in the direction in which the train is moving, have a speed equal to 60+30=90 miles per hour, and when thrown in the other direction, it will have a speed, relative to the ground, equal to 60—30=30 miles per hour. If the speed of the car be increased until it equals that of the ball (60 miles per hour), then, as before, the ball would pass through the car each way at the same speed (60 miles), but if it pass through the car in the direction in which the car is moving, it is very plain that it will have a speed, relative to the ground, equal to the speed of the car, added to the speed of the ball through the car, or 60+60=120 miles. Now, if it be thrown in the other direction, opposite to the motion of the car, it is equally plain that, notwithstanding its speed through the car is just the same as before, its speed relative to the ground will be equal to its speed through the car, minus the speed of the car; or 60—60=0; and of course when its speed or motion relative to the ground was zero, it would, if not prevented by some intervening object, such as the hands of one of the men, or the floor of the car, fall to the ground at the point at which its motion relative to the ground became zero.

This result is in entire accordance with every law of force and of moving bodies, including the one quoted in italics by our contemporary for our benefit, and any school boy of fifteen years of age, who has studied his natural philosophy to any purpose, would know that our answer was entirely correct.

Design, Construction, Repairs and Management of Marine Steam Engines and Boilers.

By W. H. Hoffman.

SEVENTH PAPER.

Referring further to the connecting-rod, it will be necessary to state that the proportions of any engine connecting-rod are subject to several conditions. A connecting-rod considered as a member of a structure to support weight only, is a strut, but as applied to an engine it is a swinging reciprocating strut, jointed and movable at both ends, and receives its transverse and vertical loads, thrusts and shocks, in varying quantities, according to the angles and pressures between dead centers. The central portion of rod must of course be strong enough to resist the maximum piston load without tremor, and the formulas generally used, which are derived from Hodgkinson's beam, column and strut formulas, will insure a safe margin of working strength, as they are based on a low factor. This factor is 3,000 pounds per inch of section for wrought-iron and mild steel, and is much too low for American marine engine practice. Any of our good wrought well-hammered forgings, are safe under 4,500 pounds per square inch, regular loads, and selected blooms will give a safe resistance to 5,000 lbs. per square inch. Our mild steel of the standard grades, and from reliable makers, is perfectly safe under a load of 6,500 pounds per inch where the ultimate strength is 54,000 pounds. We may consider the ultimate strength of all the main forgings in the chain of transmission as 54,000 pounds, and this relates to the piston rods, connecting-rods, and all cap and bearing bolts made of mild steel.

As before stated, if proper attention is given to practical methods for preventing the continuous transmission of shocks and jars to the several main reciprocating parts of an engine, these parts can be made comparatively light, and the design of these parts largely determines the speed. In calculating the proper sizes of the main transmission, I will begin at the piston-rod, and first fix the size of this very important detail. The piston-rods of our proposed engine will be a mild steel carefully hammered and moderately annealed. Our factor of safety is 8, so our piston-rods must have a clean diameter of $3\frac{7}{8}''$ at the bottom of the thread for the piston nuts; enlarged to 5″ diameter in the body of the rod, to allow for the taper fit in the piston, and to give compressive strength. This will give us a diameter suitable for all of the piston-rods; a little large for the 26″ cylinder, just right for the 40″, and a trifle under size as to appearance for the 68″ cylinder. It is, however, strong enough for the most trying service on either of the pistons, under compressive and tensile strains. The connecting-rod should have a diameter at the upper or crosshead neck, $1\frac{1}{10}$ times greater than the body of the piston-rod, as the latter is liable to tremor only from excessive and undue compressive shocks, while the former has the angular transverse strains to combat. Cutting off at $\frac{6}{10}$ of the stroke as we propose to do, we load our connecting-rod severely while it is at disadvantage, so the necks and center must present a cross section sufficient for the work. By the rule just given, we make our connecting-rod $5\frac{1}{2}''$ diameter at its upper neck, and according to Hodgkinson's rules it should be $7\frac{1}{4}''$ in diameter at the center, but his factor of strength is very low, and, therefore, calls for a clumsy rod. As I believe in a large lower neck, we shall reduce this central diameter to $7\frac{1}{4}''$, and bring the rod to $6\frac{5}{8}''$ diameter at the butt. As to the tensile strength of the upper neck, it will be seen that it presents a sectional area of $23\frac{75}{100}''$, giving us a working stress of only 3,500 pounds per square inch, and leaving a safe margin for sudden shocks, while the rod is swinging in its circular path.

The length of a connecting rod between centers, depends entirely on the character or style of the engines, and the style of the engine depends on the kind of vessel it is to propel. A light-draught sea-going boat cannot be high above the water line when loaded, and therefore must be fitted with a short stroke engine if it is of the vertical direct-acting type, and still shorter if horizontal and direct-acting. Back-acting engines give a long rod, but the objectionable features counteract the good ones. A well-proportioned sea-going vessel, however, gives room for a well-proportioned vertical engine. Instead of a short connecting-rod, say $1\frac{3}{4}$ times the stroke, we can easily have a rod $2\frac{1}{2}$ times the stroke, and experience gained from many experiments with rods of many proportions, teaches that $2\frac{1}{4}$ times is the best length. This length gives the best turning angle, and the least slide and crosshead friction, and is never troublesome from vibration under moderately high rotative speed. The length of a connecting-rod must never be excessive, as this will cause the rod to vibrate too much at the center, and thus reach the point of metallic fatigue, and jeopardize the whole structure. The "thrash" of any connecting-rod is sure to break it if the proportions are wrong.

As our connecting-rods will be 11′ 3″ from center to center, there will be ample space to make the butt and yoke ends of strong and graceful proportions, and a center and neck to match. The butt must have a thickness equal to $1\frac{1}{8}$ times the diameter of the neck at that point, which gives us $7\frac{5}{8}''$—apparently very thick; but this is necessary on account of the loss of cross section from drilling for the cap bolts.

The lower neck of the rod must be well rounded to the butt, the radius being equal to $\frac{1}{2}$ the diameter of the neck, $3\frac{5}{16}''$. The crank-pin cap bolts must be equal in cross section at the bottom of the threads to the area of the upper neck of the rod, therefore their combined areas must be 2.4″, so the bolts must each be 4″ diameter at the bottom of the threads, or $4\frac{3}{8}''$ in the body. The distance between the centers of these bolts will be $18\frac{3}{8}''$, and the extreme length of the butt will be $28\frac{1}{2}''$.

Although this may at first sight appear to be a wide end, it is not a heavy one, and on the contrary is quite light when compared with its work. Like the piston-rods, however, it is strong, and when viewed from all points is symmetrical, and handy to examine. The width of the butt must be $2\frac{1}{4}$ times the diameter of the bolts, or to make even figures 10″, and as the crank-pin boxes are 15″ long, the nose of the boxes will project $2\frac{1}{2}''$ on each side. In the butt will be a notch slotted $1\frac{1}{4}''$ deep, and $8\frac{1}{4}''$ wide, with inner corners rounded, and into which the upper half of the crank-pin box is fitted. The cap and the lower half box is fitted in the same way. This arrangement gives a compact "stub end," leaves ample thickness of butt and cap, and relieves the cap bolts from transverse sheering strains. Each half box will have a thickness in a vertical or central line of $2\frac{7}{8}''$ from the inner surface of the notch to the surface of the pin, while on the sides the extreme thickness is $1\frac{7}{8}''$. The arrangement of oil channels will be explained in another paper.

LETTERS FROM PRACTICAL MEN.

Steam Street-Car Motors in England.

Editor American Machinist:

I note your remarks in your edition of the 19th May, in reference to steam street-car motors not having had a fair trial, etc.

I visited England last year, and in the towns of Leeds and Bradford I saw quite a number, which are in constant daily use, and rode on them also. These motors run through the busiest parts of these towns, and seem to get along without any difficulty. The exhaust steam is all condensed by a large surface condenser on the roof of the motor, which, by the way, is all housed, the air playing around the pipes of the condenser, acting as the condensing medium. They travel from eight to twelve miles an hour.

Accompanying me was a late superintendent of a street railroad, who had been using two motors, but the exhaust steam had been such a source of annoyance that they had been compelled to take them off the road. The manner of running them in England was a revelation to him. W. B. Yates.

Taunton, Mass.

Large Blue Prints.

Editor American Machinist:

In your issue of May 19th I was much interested in the description of the board for taking blue prints; for, about a year ago I used a large piece of heavy pasteboard and a pad for the same purpose, and bent it, and held it in a curved position by two cords. I took some good prints that way, while at Newburgh, N. Y., then I made a flexible board with clamps, and it worked very nicely, and have been intending, since my arrival here in Chicago, to have a good board fixed for the purpose; for it is much handier than a frame and glass, and a clearer print can be taken. I am glad to see that others have found out the value of this device, for the large glass is a bugbear and expense. C. W. T.

North Side Water Works, Chicago, Ill.

Making Calipers.

Editor American Machinist:

There is no tool in more common use and none harder to find, in good quality, upon the market, than plain calipers.

We often find the apprentice boys working during spare time with chisel or center punch, cutting out caliper steel from old saws, etc. Don't do it.

Send to some saw maker, enclosing a dollar, and giving sizes, thickness, length and taper, and get a dozen pairs of steels already cut, and they are good, too. Much time is wasted when you cut them for yourselves, and as a result you have uneven dented calipers, that will not satisfy you when finished. If you have steam appliances to do the work, all right, but most common shops lack these. If you have lots of time spend it reading good mechanical works.

When you get your steel it will be crooked, and after straightening it as true as possible with a little babbitt hammer, take the rough scale off with a file or emery wheel; let this be a good finish, but not a fine one yet.

Now with your maphrodites lay off the centers for drilling the rivet holes, not hurrying this part of the job, for the old maxim "What's worth doing at all is worth doing well," never applied better than to calipers. Moisten a bit of blue vitriol in water and coat the surface slightly with copper. It is far better to mark on than chalk.

Drill one-fourth inch holes in all calipers less than twelve inches long and five-sixteenths or three-eighths in larger sizes, keeping the two pieces clamped together and lying on an iron surface flat. Now, after fastening with a common iron rivet, file the sides of the legs to a uniform taper. Your blacksmith will bend them to the proper curve, and for a pattern borrow a well bent pair from some old machinist. The greatest fault with most outside calipers is being too straight.

With a buffing wheel or emery paper clean off the fire color and scale, and give a good polish.

A correspondent in December describes in a valuable article the method of finishing the tips. Many say: Use the same stock for washers that your calipers are made from. This is wrong, for the process of riveting tends to "dish" them, and brings the bearing all at the center. Make them at least one-fourth thicker and of good cold-rolled or machinery steel. They should be turned upon a mandrel to finish the faces, true to the hole and you may exercise your taste in chamfering the outside, fancy or otherwise; countersink a little before riveting.

The rivet may be made of any good steel; but as the joint is the most important part, it will pay you to use stub steel of standard size. The cost is trifling, and the joint will be a good one. A loose rivet makes a jerky joint.

Finish all parts of the bearing perfectly with file and emery, and before the final rivet is fastened, grind with finest emery and oil. Now rivet all together and remove the hammer marks with file. You have as good a pair of calipers as the shop boasts, and one you may well be proud of; indeed, much better than you can buy.

Some suggest making the washers slightly hollowing, also others turn the bearings of the legs on a mandrel and put a thin steel washer between.

Another suggests turning the rivet with a shoulder in the center, making a distinct middle bearing for each leg.

One fellow showed me a rough pair of calipers, carelessly bent and finished, and remarked: "There is as good a pair of calipers as you ever saw, and they have been through a fire since they were made, too." His other tools correspond, needless to say. No two make tools alike; but, using your taste in finishing, with or without ornament; don't let the ornament take the place of good joints.

Make no tools that you can buy better than you can make. Time is far better spent skillfully doing your other work, or in reading and study.

Good tools go far toward a good mechanic, and you should secure them as soon as they are needed.

A good musician rarely learns to play on a poor instrument. Don't learn to work with poor tools.

Carroll L. Hoyt.

While Americans are being chided by their consuls and others regarding their supposed disposition to sit quietly down and let the English manufacturer monopolize all the foreign trade, it may prove interesting to peruse the following, taken from *Engineering* (London):

We published last week a letter from a correspondent, drawing attention to American competition in the production of gold-extracting machinery for South Africa. The American batteries at work are said to do two and half times the work of English ones of equal size, and if English manufacturers have thus allowed themselves to be outstripped in improvements it will not be surprising if orders for machinery be sent to the United States instead of to this country. At the same time, rivalry in another form is likely to tell upon English trade. The impending development of a network of railways in South Africa has attracted thither American agents, who are preparing to compete with English firms for the supply of rails and rolling stock. We trust that supineness will not be the distinguishing feature of English manufacturers in this competition.

There is just at this time a plethora of books that assume to teach a man, without previous experience, how to procure a license as stationary engineer. However honest the intention of the writers of such books may be, they are, nevertheless, calculated to deceive those who buy them. Some of these books are altogether bad, some indifferent, and some, so far as they go, good. But it is not so much the quality of the books that we object to, as it is the claim that is made for them. Let no one be deceived into the belief that he can become an engineer by any amount of reading. This will indeed improve him, but the assumption that a book engineer can pass the examination of a competent examiner is entirely ridiculous.

The average daily supply of water delivered from the Thames to London consumers during the last month, was 80,368,932 gallons; from the Lea, 57,047,492; from springs and wells, 19,116,275 gallons; from ponds at Hampstead and Highgate, 2,023 gallons. The last is used for non-domestic purposes only. The daily total was, therefore, 156,534,722 gallons for a population aggregating 5,456,587, representing a daily consumption per head of 28.68 gallons for all purposes.—*The (London) Engineer.*

To Make Square and Rectangular Columns.

By S. Bolland.

It would surprise many of our first-class machinery moulders (who affect to despise the so-called housework shops) if they were to step inside one of the many foundries

which make a specialty of architectural work, and see the admirable methods they have for pushing out work in short order. True, a great amount of the work done in these shops is of a very plain sort, requiring very little skill but any amount of muscle to accomplish; yet it must be conceded that some of the castings require men of superior ability to make them successfully.

We need only to examine critically some of our large public buildings which have their fronts mainly of cast-iron, to be convinced that something more than ordinary skill was needed to mould the massive columns and entablatures of which the structure is composed.

The moulding of what are called square columns has always been considered a leading job in a housework shop, and the man who has uniform success in their manufacture commands good wages. A common method of moulding these castings is to ram the core (in green sand) on an arbor or core iron made for the purpose; this arbor is simply a beam long enough to reach through each end, with bars cast or bolted along each side to support the sand. The core box is usually a smooth board bedded alongside the mould, with loose sides clamped firmly together to the required width. When the core has been made in this, the sides are taken off and then it can be lifted off the board and lowered into the mould. This is a rather delicate operation, and needs care to have it exactly in the center, otherwise the casting is sure to draw over on the thick side. To obviate this, studs have in some instances to be used to press the core over in the middle after the ends are secured in the center.

Another method is to make the core in dry sand, but as this is only a makeshift at best, I will dismiss it at once and proceed to explain the method which seems to me the surest, as well as the most simple way of making square and rectangular columns, or any other casting similar in form; for I am persuaded that a considerable saving might be effected in many of our machine shops by adopting some ready mode of working with green sand cores.

First consider the pattern for a column 18 inches square—the one I have chosen for illustration being of such dimensions. The drawings are made isometrically and to scale, and the strictest attention has been paid to proportion throughout; by so doing I have been able to show all the details in actual position. Fig. 1 is a view of one end of the pattern; it is seen to be a plain block, and must be made long enough to meet all requirements; it is simply four stout boards well secured to blocks at short intervals along the inside; strong screw plates must be let in on the under side and holes bored in the top, through which to let down the screw for drawing out the pattern, as seen at *A*. The arrangement for stopping-off to the required length is simple. *B* and *C* are blocks which set against stops *D* and *E*. These stops are set back at a distance from *F* sufficient to allow the front face of blocks *B* and *C*, being on a line with the mark *F*, such mark being the supposed length of the column required. When these blocks are drawn out they leave a true face against which to set the stopping-off cores. These cores are seen in position, and made good behind, at *A* and *B*, Fig. 2. The cores are about 1½ inches thick. The one at *A* has the running gates on its inner edge. An upright runner about 1¾ inches square is set against the gates before ramming behind, to be connected with the main runner at the finish.

So much for the pattern. Let us now turn our attention to the mould, and begin by discarding the old method of bedding in the floor, for another which will not only give better results as to quality of work done, but quantity also. As before stated, the column chosen for the purpose of illustration is 18 inches square. By referring to Fig. 3 it will be seen that top and bottom flasks are used, prepared with hinges for the cope to turn in. These hinges serve a good purpose in this case, since, there being no necessity to lift the cope away to finish, you merely hitch on to the staple (not shown) in front, throw the cope back at a convenient angle for finishing, and prop up behind, leaving it resting in the hinges until ready for closing.

It must be plain to anyone that there is a considerable saving of both time and room by this method of handling the cope.

The bottom flask is made up of loose sides and ends of the needed depth, held together by cross bars bolted about every 2 feet along its length. As shown it stands about 6 inches above the floor. This keeps the hinges and flange clear, and gives greater freedom to the moulder whilst working at the job. By cutting out a gap in the side of the view I am enabled to give a sectional illustration of the whole job at that particular spot. The cross bar is seen with broken line up the sides, which indicates the flanges for bolting together. The broken line at the bottom of the bar indicates a flange 4 inches wide, which answers the double purpose of stiffening the bar and supplying a surface to resist the thrust when the pressure is on the mould.

The box must be made to take in the longest columns, as short ones can be moulded in it as readily as in a shorter one. As there are to be no core prints on the pattern, it is only required to level a bed to the proper depth on which to lay the pattern, then ram up the sides and cope in the regular way, taking care to place the runners *C* and *D*, Fig. 3, convenient for connecting with those behind the cores previously spoken of.

The pattern or block being drawn, and the mould finished, we will proceed to make the core, which will be rammed in the mould with very little trouble. Figs. 2 and 4 are views of the mould at different stages of the operation of moulding the column. It is supposed that all of the front side has been taken away, thus revealing the joint, side and bottom surfaces with their several details, to be explained as we proceed. At Fig. 4 I have shown one of the loose patterns for the sides; it rests on the bottom of the mould. These patterns must be made of good and well-seasoned lumber, otherwise they will soon warp out of shape. They are to be the thickness of the casting required, with some draft allowed for easy drawing. The straps shown are of wrought-iron, and are sunk flush with the pattern. A toe is turned on the bottom, which grips the pattern, and they must be well secured with screws as shown. It will be seen at *A*, Fig. 4, that the stopping-off block has been taken out and the core previously spoken of set against the end of the pattern; but as it is not expected to cut these patterns to the length of column every time, the blocks at the opposite end remain where they are until the patterns have been taken out. The opening cores marked *C D E F G*, Fig. 2, are now to be set in their places, and the ones *H* and *I* must be set exactly in line with the front face of the blocks. All these cores are to be the thickness of the column on that side, and when in their places are to be covered with other cores made in lengths suitable for easy handling, and the width of the space between the side patterns. I have shown these cores in position from end to end in Fig. 4. If they are carefully made and fitted snugly together there will be no fear of any sand working its way down into the mould. After spreading a little sand all along the cores, set down the beam or arbor, making sure that it rests solid on them all.

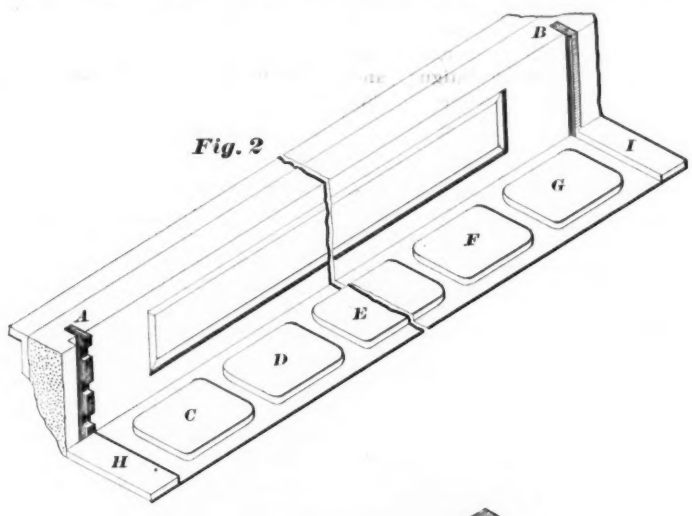


Fig. 2

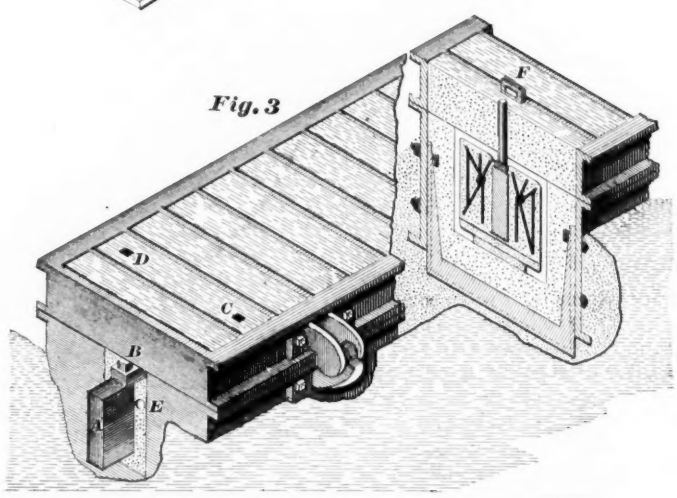


Fig. 3

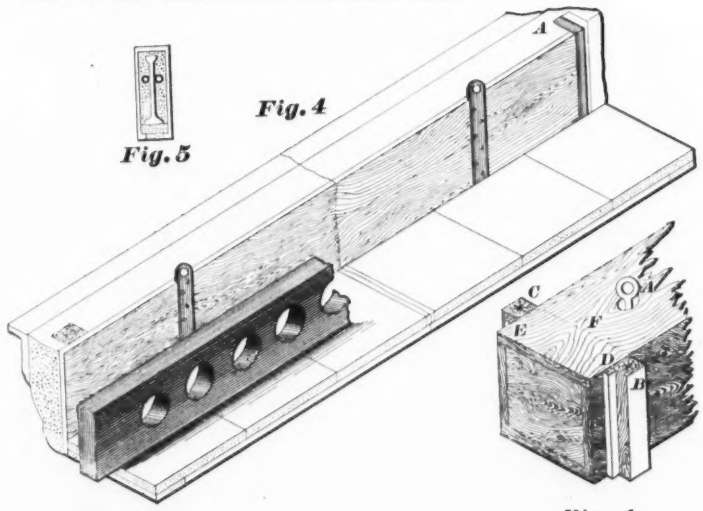


Fig. 4

Fig. 5

Fig. 1.

I have shown a portion of this arbor in position at Fig. 4; it is simply a beam cast on its flat, in open sand, and can be used for all widths over 8 inches. When smaller than this it is safer to use a wrought-iron beam with holes drilled along its length. The plate being thin it allows of more sand round the arbor, and is consequently safer. Fig. 5 will explain what I mean. If the reader will look at the cross section of Fig. 3 he will see the disposition made of the core arbor; the figure is purposely cut across the mould just where the stud is used for holding down the arbor; the stud is seen standing through the cope and resting on a loose packing, which is placed on the arbor a little below the surface of the core, to give extra thickness at that place.

The best material for making the core is the heap or floor sand, not over-moist, but well mixed and shook through a coarse riddle; but should the heap be very rotten on account of a preponderance of burnt sand, then a little new may be well mixed through it. Avoid adding sea coal by all means, as it only creates gas, and there is quite sufficient for this purpose in the old sand which is used. I might add that it is best to face the runner end for a short distance with the regular facing sand mixture, to prevent the gates from cutting the core at that spot.

To vent the core I have shown a ¼-inch rod laid on each side of the arbor, about two-thirds of the distance from the bottom; when the ramming has reached within ¼-inch from the top, vent in the direction of the rods, as shown in Fig. 3. These long rods must be drawn before the side patterns are taken out and shorter ones pushed in at the ends, to be withdrawn after the cope is on and the ends secured. One of these vents is seen at *E*, Fig. 3. In ramming cores of this kind it is always best to put in a little at a time, in order to pack it solid without being unnecessarily hard.

All that remains to be done after the patterns are taken out, is to set in the stop-off cores *A*, Fig. 2, with the upright runners, and connect with the cope runners, as previously directed.

I have shown in Fig. 3 a device for securing the arbor *A*. It projects through the ends of the flask, and is wedged under the cope at *B*; but provision must be made for holding it down in the middle also. It will be seen at *F* that a clamp is cast in the box bar, also in the next bar to it; but as this one has been taken away to admit of this view, it cannot be seen. The packing on the arbor must be placed so that the stud can be let down on it after the cope is on. A flat bar can be then pushed through the slot, which must rest on the stud, and a wedge at one or both ends secures it.

The column we have been considering is supposed to be a plain one on all its sides, and if panels or mouldings are added only on the top side it makes very little difference to the moulding of the column. But often these embellishments are cast on one or both of the sides as well, as seen at Fig. 2. When this is the case, the best method of moulding such is as I suggested in an article on Hinged Flasks, published in the AMERICAN MACHINIST for November 26th, 1887. But if a superior class of work is not desired, draw out the patterns and finish the mould, then set against the side, strips of iron one-eighth or three-sixteenths thick, 6 inches wide and the full depth of the mould, from 9 to 12 inches apart, against which the patterns for the sides will be set (of course they will require to be as much thinner as is the thickness of the strips used.) The object of this is to prevent the patterns from rubbing against the finished mould whilst drawing them out.

By having iron strips, all the trouble from warping is obviated; if care is taken to have enough of them to prevent the ramming from pressing too hard against the mould, and thus leaving their impression, a very fair casting can be made this way.

By the adoption of this method much time is saved, and risk reduced to a minimum; also, the core being rammed in its place insures an absolutely even thickness, in consequence of which the result is a straight casting every time.

AMERICAN MACHINIST

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F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

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NEW YORK, JUNE 2, 1888.

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The Mechanical Engineers at Nashville.

The attendance at the Nashville meeting of the A. S. M. E. was smaller than at any meeting which has been held for some time. The membership in the South is as yet small, and the distance and time required to make the trip had a tendency to keep Northern and Eastern members at home.

The meeting will be remembered with pleasure by the members, however, and will prove profitable to many of them—rather freely interspersed with excursions and sight-seeing, but very enjoyable. They will also remember the efforts of the local committee and the citizens to make them at home.

The number of papers was large, and the brief time that could be devoted to their presentation did not give much opportunity in the way of discussion; but the warm weather, or something else, tended to keep members quiet, so not much time was needed for discussion.

It is coming every year to be more and more the custom to send discussions of papers to the secretary after adjournment, and this, with the cutting of the papers short in the reading, makes the proceedings uninteresting to the general public, if not to the members. Possibly, fewer papers, more generally discussed, would be found to increase the interest at these meetings. However this may be, the means afforded the members to get together before and after the sessions, and discuss, informally, matters of mutual interest, is a valuable feature, and one not likely to be lost sight of.

The society was well received, being welcomed to Tennessee by Gov. Taylor, and to Nashville by Mayor McCarver. Every opportunity was offered to see the institutions and places of interest, and many members went home with something to think of in the future prospects of Tennessee in the way of manufacture, being much impressed with the evidences of mechanical and manufacturing progress visible everywhere, and particularly at Nashville.

Altogether, the Tennessee meeting will no doubt be a profitable one to many who attended it; if another meeting were to be held in the South the attendance would probably be larger; this one was something in the nature of an experiment.

Exemption from Taxation.

Exemption of new manufacturing enterprises from taxation, for a definite period of time, has come to be quite a common inducement, held out to manufacturers by many cities and towns anxious to secure for themselves the advantages attending the establishment of manufactures, and we have no doubt that many towns have found it to be decidedly advantageous to offer such an inducement. At least the increase in the aggregate wealth of the community as a result of the establishment and carrying on of such enterprises, has seemed to justify the measure, though it could probably be shown that in very many such cases the majority of citizens living in such towns are in no way benefited by it. We have before called attention to the manifest injustice of attracting new manufactures in that way, and at the same time continuing to collect burdensome taxes from old established concerns, which have in many cases been the chief cause of the development of the town to the point where it was in a position to hold out any inducements whatever to manufactures, and this injustice amounts to a positive outrage when the new concerns are of such a character as to compete with the old ones; and it is not true in anything like a general sense that the increase in the value of real estate caused by the acquisition of new enterprises is a partial recompense to the old concerns, because high land values *per se* are not advantageous to manufacturers, but just to the contrary; a given piece of land purchased and used for manufacturing purposes at $25 per acre is in no way improved for manufacturing purposes because its value afterwards increases to $1,000 per acre, and such increase in value, if brought about by the growth of the town consequent upon industrial development, cannot be justly held to be any offset against the increased burdens laid upon its owners in the way of taxation. Besides, such a distinction between old and new enterprises often leads to strange inconsistencies; for instance towns are sometimes put into the position of saying to new enterprises, "Come to us, we will charge you nothing for the privilege of owning land and building shops, and putting in machinery, and whatever extra expense may be caused to us by your coming, in the way of increased water-works capacity, fire protection, police, lighting, etc., we will assess upon those already here; you shall have none of it to pay;" while on the other hand it says to the old establishments, "If you, by your enterprise, build up your business so that it becomes necessary for you to enlarge your works, and to use twice as much machinery, and employ twice as many men as you now employ, though your doing so may be fully as advantageous to the town as the establishment here of a new manufacturing concern, yet your taxes shall be promptly doubled; you shall pay a fine for your activity and enterprise."

James Gillet.

It becomes our painful duty to announce the death, on Sunday, May 13th, of Mr. James Gillet, senior editor of the *National Car and Locomotive Builder*. Mr. Gillet was born at Columbus, Ohio, June 17th, 1818, being, therefore, at the time of his death, nearly 70 years of age. His first newspaper work was done on the *Ohio State Journal*, the office of which he first entered as bookkeeper, afterwards becoming reporter of legislative proceedings, and finally one of the editors of that paper. He was afterwards engaged in various business enterprises in Florida and Brooklyn. At the establishment of the *National Car Builder*, in 1870, he became its editor, a position which he held at the time of his death. Though he had been in ill health for some time, and his death was therefore not entirely unexpected, it will be none the less painful to his many friends and acquaintances.

There is one trust recently formed which it seems to us need not become very oppressive, for the simple reason that the United States Government offers means of relief from it. We refer to the envelope trust. There are, it seems, nine members in this trust, and by them there is paid into its treasury $28,000 monthly for such distribution as may be agreed upon. In order to secure a monopoly of a certain machine, they have subsidized the maker of it, agreeing to buy of him one machine each month for five years, and to pay him a fixed price per month, whether the machine is taken or not; he on his part, agreeing neither to make nor repair a machine for any one outside of the trust.

It has been quite successful in the usual business of similar organizations, and has bankrupted several outside manufacturers, and bought up their plants. But in view of the fact that the Government furnishes envelopes of a superior quality, and which are certainly more convenient than ordinary ones, at a price which is not, to say the least, oppressive, it would seem as though the general public need not be injured very greatly by the envelope trust.

The mechanical schools of the country are doing good work in one direction, viz., in exciting a greater interest in testing materials of engineering and manufacture. And in many instances they are affording opportunities for manufacturers to have materials tested at a small cost. There is a good field for them to work in this last named direction. Such schools can afford to do this work at low cost, because it is excellent exercise for students in an educational direction. And doing it, while it will not interfere with any established business, will undoubtedly foster the habit of testing of materials, to the end of getting a better knowledge of what is being used in construction.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(273) G. A. W., Cincinnati, Ohio, asks: Please state the correct mode of making blue prints from mechanical drawings. *A.*—Make a tracing of the drawing on tracing cloth, and then proceed as explained in answer to Question 449, AMERICAN MACHINIST, Nov. 5, 1887, or follow the instructions given in our issue of Jan. 1, page 6, 1887, or Jan. 29, page 1, 1887.

(274) A. B. C., Rockland, Maine, asks: Can I get the same results by sounding an ordinary steam whistle with compressed air, as I should by using steam? Pressure, steam or air space, piping, etc., being equal in each case. *A.*—The results with the exception of the tone of the sound, will be the same in both cases.

(275) J. E. Q., Orange, Mass., writes: Will you kindly inform me if a coil of ¾ inch pipe containing 6 feet be attached to a boiler 15 inches long, 7 inches diameter, and placed inside of a coal stove, would generate steam enough to run an engine 1½ inch bore and 3 inches stroke at a pressure of 20 to 30 pounds. *A.*—Your description is not definite enough for us to state whether it will answer your purpose or not. But we believe it is safe to say that the boiler will generate enough steam for a first-class explosion. It is a dangerous arrangement; do not try it.

(276) J. McN., Roanoke, Va., asks: Kindly tell me how to determine the horse power of a boiler? *A.*—Some builders allow 15 square feet of heating surface for one horse-power; others allow only 10 square feet of heating surface per horse-power. We prefer the former figure. Hence, find the total heating surface, and divide by 15; the quotient will be the horse-power of the boiler. But it must not be understood that for every horse-power developed by the engine, 15 square feet of heating surface will be required; some engines will require considerably less heating surface. The rule we have given is only for a general approximation of the power of a boiler.

(277) W. K., —— writes: Please give me the rule for finding the number of gallons a tank will hold. A.—Multiply the length by the breadth of the tank in inches, then multiply this product by the height of the tank in inches, the last product will be the number of cubic inches in the tank. Since a gallon contains 231 cubic inches, divide the product previously obtained by 231, the quotient will be the number of gallons in the tank. For very precise calculations the temperature of the water should be taken into account, but for all ordinary purposes the temperature is not taken into consideration.

(278) Brass, Norwich, Conn., writes: 1. Will you please inform me as to the best way to obtain clean and bright looking brass castings? Is a flux used? If so, what, and how is it used? *A.*—On careful inquiry we find that there is a flux made for the purpose, but does not seem to give satisfactory results. The only way to obtain good, clean and bright looking brass castings is carefulness in moulding, the use of the best of metals, and cleanliness in pouring. 2. Give good composition mixture, one that is soft to finish, tough and good color. *A.*—See AMERICAN MACHINIST, page 3, Oct. 29, 1887. We believe the mixture there given for pumps will answer your purpose.

(279) G. W., Perth Amboy, N. J., writes: I have a boat 14' x 4', a bateau. I am thinking of putting in a pair of side wheels 3 feet diamater, paddles, 8" x 6". Will I get power and speed by working it with a crank direct? *A.*—With this arrangement you will probably obtain the best results. But whether both the power and the speed will be satisfactory to you we cannot tell, since you do not state the load to be carried, neither do you give us any idea as to the lines of the boat. 2. I have thought of putting a shaft across and putting a 2-feet pulley, 4-inch face on the same, and driving it with a 4-inch belt from a 10-inch pulley attached to the crank. I would like your advice as to which you think is best, the direct crank motion or the pulley motion. *A.*—The direct crank motion.

(280) J. H. C., Indianapolis, Ind., writes: 1. In a battery of three or more boilers connected together with both steam and water, is there any danger of the water leaving one boiler and going into the others? *A.*—There is some danger; but there is a greater danger of the feed-water entering some of the boilers, and not into others of the same battery, caused by bad firing. All trouble and dangers of this kind can be avoided by careful firing and watchfulness. Are there any rules for finding the safe working pressure of a boiler? *A.*—Yes, see answer to Question 138, AMERICAN MACHINIST, March 26, 1887. 3. Will any advantage be gained by feeding oil through the inspirators? *A.*—Not that we know of.

(281) J. L., Boston, Mass., asks: Please give me a formula by which I can determine the amount of water that will run through any size pipe in a given time; I fail to find it in Haswell's and in several standard works. *A.*—You will find the desired information in Haswell's, Trautwine's or any other good engineers' pocket book; you must have overlooked it. In determining the amount of water which will flow through any size of pipe, friction must be allowed for, and the amount will depend on the diameter, length of pipe and other conditions. Taking the friction into consideration makes the formula somewhat complicated, the subject difficult to understand, and the explanation will require too much space in these columns; hence the following rules are only applicable to the flow of water through openings or apertures in the sides or bottom of the containing vessel. Theoretically the velocity with which water should flow through such an opening is equal to the velocity which would be acquired by a heavy body falling freely through a height equal to the head, or depth of water, measured vertically from the level surface of the water in the vessel to the bottom of the opening when the latter is in the bottom of the vessel; and to the center of the opening, or more correctly to its center of gravity, when the opening is in the side of the vessel. This theoretical velocity is found in feet per second by multiplying the square root of said head, or vertical depth in feet by the constant number 8.025; or multiplying the head itself in feet, by 64.4 and take the square root of the product. In practice we may use 8 and 64, as near enough. The theoretical, as well as the actual discharge, or the quantity in cubic feet, which flows out per second, is evidently, equal in all cases to the product of the theoretical, or of the actual velocity in feet per second multiplied by the area of the opening in square feet. We may put these rules in the shape of a formula, thus: Let h represent the head or vertical depth in feet; v the velocity in feet per second, a the area of the opening in square feet, and Q the quantity of water in cubic feet discharged per second. We have

$$v = \sqrt{64 \times h}$$

or

$$v = 8 \times \sqrt{h}$$
$$Q = av$$

(282) W. L., Newburgh, N. Y., writes: Please give a general explanation of the mode of springing steam piston rings against the walls of the cylinder, as per inclosed sketch. The cylinder is 46 inches diameter, ring 1⅛ inch wide, 1⅛ inch thick, and turned to lay closely to wall of cylinder. The ring is to be kept against the wall of cylinder by means of two spiral springs; one end of each spring is fastened to the ring, close to where it is cut open, the other end of each spring is fastened to the spider. What we want to know is, what will be the tension throughout the ring, and what will be the pressure per square inch of ring surface against cylinder wall. The pull or tension on each spring is 15 pounds. Also whether, in your opinion, is this mode of setting rings against cylinder wall as good as to spring the entire circle. The piston is for a horizontal cylinder. Provision is to be made for center ring, and steadying piston by means of junk or bull ring. *A.*—The pressure of the rings against the wall of the cylinder, due to the tension of the springs, will depend on the position—in the spider and ring—of the studs to which the springs are fastened, and these positions are not clearly defined in your sketch; consequently we cannot give you the pressure of the rings against the wall of the cylinder. You may find the pressure due to the tension of the spring by constructing around the center line of each spring a parallelogram of forces in which the tension acting in the direction of center line of the spring is the resultant of two forces, one of which is acting in a horizontal direction, and the other in a vertical direction. By so doing you obtain the magnitude of the forces acting in the vertical and horizontal direction against the wall of the cylinder, and with this data the pressure per square inch against the walls of the cylinder can be approximately determined. We say approximately, because factors, for which it is difficult to assign, accurate values, will enter into the calculation. Thus: Since your springs are placed near the top of the cylinder, and the cylinder is a horizontal one, the force which acts in a horizontal direction and at right angles to the axis of the cylinder, that is one of the two forces of which the tension of the spring acting in the direction of its center line is the resultant, will partly be expended in producing a pressure of the rings against the wall of the cylinder, and partly expended in forcing the ends of the ring apart; to determine the amount of the force required for forcing the ends of the ring apart will be a difficult task, as the amount depends upon the elasticity of the iron and also on fit of the rings in the cylinder, and to some extent on the expansion of the rings. Again, in the action of the force which acts in a vertical direction, we find a very objectionable feature. This force, instead of forcing the packing rings against the walls of the cylinder, as it should do, constantly tends to draw them away from the same. Hence, it follows that the pressure of the rings against the walls of the cylinder will not be uniform, and may possibly vary from nothing at the top of the cylinder to about 1-10 of a pound per square inch at the bottom, besides the pressure due to the weight of the piston. In extending the examination of this mode of setting the rings against the walls of the cylinder, it will become apparent that as the packing rims wear, their strength to resist the vertical force due to the tension of the springs, will gradually decrease, and a leak at the top of the cylinder will be the result. We are of the opinion that this mode of setting the rings against the walls of the cylinder is not a good one.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

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Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link Belt Machinery Co., Chicago and N. Y.

Taper attachment on all lathes Lodge, Davis & Co.
Compound rest on all lathes Lodge, Davis & Co.
Power cross-feed on all lathes Lodge, Davis & Co.
Large hollow spindle on all lathes Lodge, Davis & Co.
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See special ads. pages 15 and 16 Lodge, Davis & Co.

Shafting Straighteners. J. H. Wells, Tampa, Fla.
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
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Burnham's turbine wheel is sold at net price to mill owners. Catalogue free. Address York, Pa.
Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.
Silk wiping towels are better and cheaper than waste. S. A. Smith, 23 South Canal st., Chicago, Ill.
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For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.
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Artesian, salt and oil well pumps; sucker rods and deep well supplies; wrought-iron tubing and steam pipe. Hardwicke & Ware, Buffalo, N. Y.
Model engines and castings. Prices $3.75, $4.75 and $5.75. For descriptive circular apply to Montgomery & Co., 105 Fulton street, New York city.
Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See May 5, p 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
Robertson's damper regulator; no diaphragms, springs or packing; the cheapest good regulator in market. Hine & Robertson, 45 Cortlandt st., N. Y.
Machinists' supplies, brass goods, m't'rs supplies, polishing materials, all kinds wire, metals, etc., in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.
For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.
Patent Att'y. R. G. DuBois, 916 F. st., Washington, D. C. Reliable service at reasonable rates. Send for 38-page pamphlet containing list of references.
How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.
Parties requiring milling machine or screw machine work furnished, in large or small quantities, please write to the manufacturers, E. E. Garvin & Co., 139, 141, 143 Centre st., New York City.
The Dieble Mfg. Co., Philadelphia, Pa., mfrs. of the Challenge emery grinding and polishing machinery, invite correspondence with all needing this class of machinery. Catalogues and prices on application.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.
For the manufacture of
Patented articles in line of machine work;
Specialties in fine light machinery;
Accurate cam cutting,
Address Wardwell S. M. Co., Woonsocket, R. I.
Jas. D. Cardell & Co., 1900 Passyunk ave., Phila., Pa., will remove June 1st to Rising Sun Lane and North Penn. R. R., where they will continue manufacture of coils of wrought-iron pipe for ice machines, soap works, boilers, tanks, etc.
Hot Water Supply. A practical treatise on the fitting of hot water apparatus for domestic and general purposes. By F. Dye. 82 pages with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 12 Cortlandt st., N. Y.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price $2, post paid. Published by John Wiley & Sons, 15 Astor Place, New York.
"Binders" for the AMERICAN MACHINIST. Two styles - the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.
The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including June 2, 1888 issue, 51 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.
"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 65 articles have thus far appeared up to and including the May 26, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Water-works are being agitated at Lonoke, Ark.

Killebrew Bros. & See, of Bluffton, Ga., will build a planing mill.

Wm. Deavill & Son, Philadelphia, will erect a machine shop at Nicetown, Pa.

The city council of Carrollton, Ga., are considering the question of water-works.

At Toledo, Ohio, a knitting company has been organized with a capital of $60,000.

C. J. Wilson, Milledgeville, Ga., intends to remove his machine works to Anniston, Ala.

The works of the Woods Engine and Machine Company, St. Louis, are being enlarged.

At Selma, Ala., J. N. Hutchinson is erecting a grist mill, and expects to add a flour mill.

At Clermont, Fla., a company has been formed to start an ice factory. W. Huber is interested.

The first cutlery works in the State of Kansas are about to be started up at Newton by W. J. Miles, jr.

At Sacramento, Cal., the Southern Pacific Company's shops will be enlarged. They now employ about 2,160 men.

The Pennsylvania Steel Company, of Steelton, are experimenting with oil as fuel for one of their open hearth furnaces.

The Talladega & Coosa Valley Railroad Co. will build a roundhouse and repair machine shops at Talladega, Ala.

Citizens of Louisville, Ky., have subscribed $200,000, to establish a cotton mill, and the building is to be commenced at once.

The buildings of the United States Rolling Stock Company at Anniston, Ala., are being enlarged, the work being well under way.

At Anniston, Ala., the Alabama Ice Company have let the contract for factory buildings with a capacity for 10 tons per day.

Recently there was turned out at the shops of Pinder & Co., Anniston, Ala., what is said to be the first locomotive ever built south of Virginia.

The town of Lebanon, Kentucky, will decide by popular vote, on May 12, whether or not to issue bonds to the amount of $60,000 for water-works.

It is reported that Thomas A. Edison has recently purchased land in West Orange, N. J., and will erect works for the Edison Phonograph Company.

A Philadelphia company proposes to build large steel works at Latrobe, Pa. The citizens have already donated $14,000 to secure the establishment.

The works of Carmen & Thompson at Lewiston, Maine, are soon to be enlarged, to enable them to supply the demand for their steam heating apparatus.

The Cincinnati Forge Works will remove to Muncie, Ind., in consequence of free ground, buildings, and a gas well, which have been donated by the citizens.

A wire company has been organized in New Haven, Conn., of which H. C. Warren is president, and Wallace Bradley secretary and treasurer. $10,000 capital.

At Haydens Rolling Mill at Columbus, Ohio, a new furnace has been put in, which manufactures the gas by which the furnace which melts the iron is heated. A great saving is claimed for it.

At Livermore Falls, Maine, an iron foundry is to be started by A. B. Jewett and Ernest Keene. It is expected to be ready for work in about a month, some of the machinery having already arrived.

The plant of the Siemens Anderson Steel Company at Pittsburgh, which was built to make steel direct from the ore, has been purchased by the Linden Steel Company, Limited, who will use it for their present and prospective needs.

We have received the new 1888 catalogue of the Westcott Chuck Company, of Oneida, N. Y., containing full descriptions, with general detail and sectional views of the many varieties of lathe and drill chucks made by them, together with prices.

It is said that the iron ore at Iron Mountain and Pilot Knob, Mo., has been exhausted, and that in consequence the Vulcan Iron Works will be removed to Cleveland, Ohio. The shipments have fallen off from 22,000 tons per month to 6,000 tons per month.

At West Superior, Wis., about 200 men are at work preparing the ground for the erection of a blast furnace by the Land and River Improvement Company. It will have a capacity for 200 tons per day. It is intended to ultimately erect a steel rail mill at Superior.

At a recent meeting of the Henderson Steel and Manufacturing Company, held at Birmingham, Ala., it was decided to increase the capital stock, and as soon as possible to erect a large plant for steel making. They are looking for a favorable location for the new works.

The Chemical Steel Company, of Birmingham, Ala., have been organized to manufacture steel, under the patents of Prof. W. A. Pratt, State Geologist of Georgia. C. C. King is secretary, and J. B. Hill general manager. The process will soon be tested at one of the Birmingham furnaces.

Hardwicke & Ware, Buffalo, N. Y., write us: "We completed and shipped via 'Frisco a few days ago, an order for a large number of our oil well pumping outfits for an Australian firm. This is the eighth order we have now received for oil well goods from the Antipodes—six for Melbourne and two for New Zealand."

We have received the new illustrated catalogue of P. Blaisdell & Co., Worcester, Mass., containing cuts and information concerning the machine tools built by them, including engine lathes, planers, boring mills, gear cutters, hand lathes, and their patent drill press, besides other tools and machines useful in machine shops.

Kelly & Jones Co., of 75 John street, New York, having closed up their factory in Jersey City, will remove their manufacturing plant to Greensburg, Pa., near Pittsburgh, where they will largely increase their manufacturing capacity. The town has given them, as an inducement, 13 acres of land and a bonus of $50,000.

The Laidlaw & Dunn Company, of Cincinnati, O., have been awarded the contract for two of their "Duplex" steam pumps to pump water for the grand water falls and fountains in Horticultural Hall, and also for the large elevator pump for Washington Park Department, at the Cincinnati Centennial Exposition, opening July 4 and closing Oct. 27.

C. T. Swift and John G. Burkhardt, of Atlanta and others of Columbus, have purchased a site to build at once a cotton mill to manufacture a finer grade of ginghams, seersuckers, etc., than are now made in the South. The capacity will be for 500 looms, and the cost about $150,000. The mill building will be one story, 120 x 220 feet.—*Manufacturers' Record.*

A rail mill, having a capacity for 300 tons of steel rails per day, is to be built about twelve miles up the Monongahela river, where the newly completed plant of the Duquesne Steel Company is located. The Allegheny Bessemer Steel Company have purchased the latter, and will run the rail mill in connection with them. It is expected to cost $150,000, and will be completed as soon as possible.

The heaviest spur wheel ever made in the United States was cast by the Walker Manufacturing Company, of this city, last evening, at 6.45 o'clock. It is machine molded, and weighs 50,000 pounds. It is intended to be the main driving wheel of the St. Louis Cable Railway's new plant. This is said to be the largest cable railway in the world, and it will be in operation before the Democratic convention. —*The Cleveland Leader.*

It would seem as though some progress was being made in steam car-heating, from the fact that during the past winter the Mason Regulator Company, of Boston, received and filled orders for over 200 reducing valves for the Martin Car Heating Company more than 100 for the Sewall Car Heating Company and other orders from Standard and Erie Car Heating Companies. The Mason Company are now putting on the market a valve for automatically regulating the pumps on air brakes.

What is said to be the largest rock breaker ever made has just been completed by the Gates Iron Works, of Chicago, for the Cambria Iron Works, of Johnstown, Pa. It will have three openings for the admission of rock, each 18 × 18 × 45 inches, and will have a capacity of 125 tons of rock per hour. It is to be used for crushing flux for the Cambria Iron Co's blast furnaces. The machine will weigh 35 tons, and is expected to require about 125 horsepower to run it.

We acknowledge the receipt of catalogue of the Pond Engineering Company, St. Louis, revised and enlarged for 1888. Besides cuts and description of a very full line of steam and hydraulic machinery, of various makes, it contains useful tables and some valuable data on steam and hydraulic engineering. It is one of those catalogues which will prove convenient to have at hand by those interested in such matters, and will be sent to interested parties on application.

Mr. Frank Steffner, Superintendent of the Ybor City Ice Company, Tampa, Fla., writes us that Tampa is in a flourishing condition, and is becoming noted for its tobacco industries, several large factories being there, with a combined capital of more than twenty million dollars. He states that the factories of R. Monne, of New York, are to be moved there, free ground and $11,000 for building having been donated by the citizens. Water-works are being built by the Peter & Boardman Gas and Water Works, of Macon, Ga. Two large Worthington duplex pumps are to be used. Electric lighting has been introduced and a two-hundred thousand dollar hotel is to be built.

An enterprise was recently organized at Birmingham under the name of the Chemical Steel Company, and with an authorized capital stock of $1,000,000, which aims at the greatest industrial revolution that could be effected for that region, and a very important one for the country at large. The company own a process patented by Prof. W. A. Pratt, State Geologist of Georgia, by which to turn out bessemer steel from an iron furnace without stopping to make pig. The conversion is effected by the introduction into the blow pipes of the furnace of a chemical compound which eliminates the excessive phosphorus from the ores. It is said that the process has been satisfactorily tested at the Cedartown (Ga.) furnace. It is given out that the company has been offered $100,000 for their Alabama right.—*American Manufacturer.*

Machinists' Supplies and Iron.

New York, May 17, 1888.

Iron—American Pig—A lower basis of values has been established, although it is claimed that sales are really no lower in price on the average than for some months past. We quote Lehigh brands of No. 1 X Foundry, $18, and No. 2 X, $17; Grey Forge, $16 to $16.50.

✻WANTED✻

"Situation and Help." Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to examine S. S. planes; see p 11.

Five good machinists wanted by the Rawson Mfg. Co., Hornellsville, N. Y.

Wanted—Foundry foreman; must be capable to turn out first-class engine castings. Address 522 West Fifth street, Davenport, Iowa.

An exp'd machinist and toolmaker wants a position; can give satisfactory ref.: steel tools and general machine work. Address W.C. F., Am. Machinist.

Mechanical draftsman wanted; we have a vacancy for one who has had experience in hydraulic work. Buckeye Iron and Brass Works, Dayton, O

Young draftsman, experienced, with first-class ability at designing light mach'y for special purposes, wants work or position. Box 100, Am. Machinist.

Wanted—Foreman to take charge of machine shop who is thoroughly conversant with engine and jobbing work; state age, experience and references; first-class opportunity for proper party. Address Iron Works, care Savage & Farnum, Detroit, Mich.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Wanted—Parties having machinery specialties to build, to correspond with. Box 75, Am. Machinist.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

For Sale. A pair of engines, new, 2½″ x 2½″: balance valve and link motions; $75 cash. Address 1313 Third ave., Beaver Falls, Pa.

Wanted—Parties having specialties to manufacture, correspond with Cedar Point Foundry and Machine Shop, Port Henry, Essex Co., N. Y.

Wanted—To correspond with parties in fine tool manufacture, to take hold of an excellent tool, which, after three years' test, proves superior to all others. Address Box 99, Am. Machinist.

August C. Christensen, 26 Church st., N. Y. mech. and hydr. engineer. Prepares designs of waterworks pumping stations, drawings of steam pumps, pumping engines, gen. mach'ry and pat. drawings.

Wanted—A 60″x60″ planer to plane from 15 to 30 feet, either new or second-hand. If second-hand, must be of modern design and in first-class order. Address Fosdick & Plucker, Sixth and Culvert, Cincinnati, Ohio.

For Sale—A 400 horse-power vertical engine, 22 inch diameter, 30 inch stroke, 10 inch steel shaft, two pulleys, 12 feet diameter each, for 18 inch belt. Automatic cut-off, balanced steam valve, speeded for 150 revolutions per minute. Weight, 65,000 pounds. Designed and built by Prof. John E. Sweet, of the Straight Line Engine Co. A first-class machine, practically new. Address W. B. Cogswell, Gen'l Manager, The Solvay Process Co., Syracuse, N. Y.

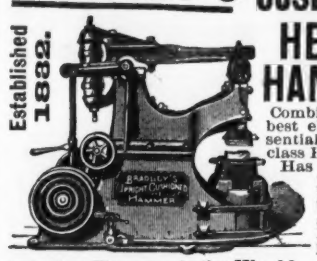
JOHN WILEY & SONS, 15 ASTOR PL, NEW YORK.
PUBLISHERS OF
SCIENTIFIC AND INDUSTRIAL WORKS.
Send for Catalogues and Circulars.—Free by mail.

"Star" Foot Lathe Swings 9x25 in. LATHE Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers. Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y

ROSE POLYTECHNIC INSTITUTE,
TERRE HAUTE, IND.—A SCHOOL OF ENGINEERING.
Well endowed, well equipped departments of Mechanical and Civil Engineering, Electricity, Chemistry and Drawing. Extensive Shops and Laboratories. For Catalogue, address
T. C. MENDENHALL, Pres.

DRILLING MACHINES.
ALL STYLES WITH
Latest Designs and Improvements.
For cuts and prices address,
BICKFORD DRILL CO.,
Front & Pike Sts., Cincinnati, O.

One Man can use **Mole's Tire Shrinker.** It is the simplest and most durable **Tire Shrinker** made. Rights for sale. Territory to suit. Patterns furnished. No fancy prices.
Address JOHN G. MOLE, Patentee, Batavia, Ill.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER
Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

Bradley's HEATING FORGES
Established 1832

Pat. Aug. 30, 1887
With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements.
For hard coal or coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.
BRADLEY & CO., Syracuse, N.Y.

STEPHENS PATENT VISES.

ONE HALF TIME and LABOR saved by using this solid, strong, durable, firm hold, quick-working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular.
TOWER & LYON,
95 Chambers Street, New York.
Successors to Melvin Stephens.

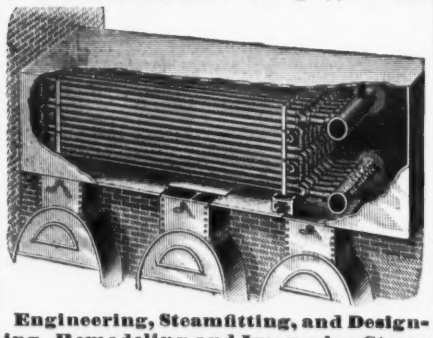
TANITE EMERY WHEELS and GRINDING MACHINES
FOR SAW MILLS, FOUNDRIES AND MACHINE SHOPS.
For Circulars address
THE TANITE COMPANY, STROUDSBURG, MONROE CO., PA.
Or H. A. ROGERS, 19 John St., N. Y.

Gap Lathe, $125.
SHEPARD'S NEW $60 SCREW-CUTTING FOOT LATHE.
Foot and Power Lathes, Drill Presses, Scroll-saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc.
Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address, H. L. SHEPARD, Agent, 124 E. Second St., Cincinnati, O.

American Standard Gauge & Tool Works, Wilmington, Del.
Makers of Implements for Standard Measurements.

Over 35,000 in Use.

Crescent Gauge. Flat Bar Gauge.
JAS. A. TAYLOR & CO.

THE HUSSEY RE-HEATER and STEAM PLANT IMPROVEMENT CO.
A. S. HATCH, President, } 15 Cortlandt Street, NEW YORK.
S. D. BREWER, Gen'l Man'g'r, }

Engineering, Steamfitting, and Designing, Remodeling and Improving Steam Plants. Consulting experts in all matters pertaining to the use of Steam and Heat.

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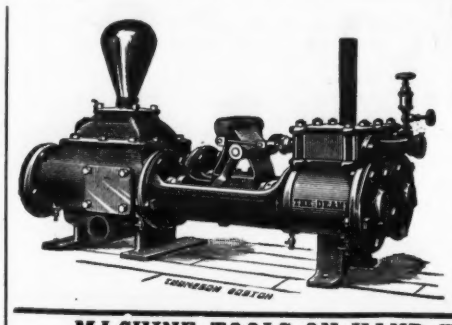
WATER WORKS PUMPING ENGINES A SPECIALTY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Manufacturers of
STEAM and POWER
PUMPS
FOR ALL PURPOSES.
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15in., 24in. and 25in. Pillar Shapers. 15in. and 20in. Traverse Shapers, 10in., 16in. and 22in. Planers. 18in. x 6, 8, 10 or 12ft. Engine Lathes, (New Pattern.) 10, 12 and 15in. Speed Lathes. Larger size Planers at short notice. Also our Forming Lathe for special brass work. A few 2d hand tools also on hand.
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STEEL In BARS, BLOCKS, SHEETS, RODS and WIRE of the finest quality used for TOOLS and DIES of every description. MACHINERY, SPRING and all other grades for general purposes.
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Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
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OUR NEW 18 in. POWER ENGINE LATHE IS NOW READY

GUILD & GARRISON, Kent Ave. and South 10th St., Brooklyn, N.Y.
Builders of Steam Pumps, Vacuum Pumps, Vacuum Apparatus, Filter-press Pumps, Air Compressors, etc.

Iron Foundry of T. Shriver & Co.,
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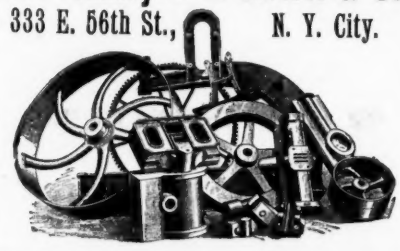
Nice Castings, Smooth and True to Patterns, of very best brands of Pig Iron.
CASTINGS IN QUANTITY AT FAVORABLE PRICES.

BALDWINSVILLE CENTRIFUGAL PUMP WORKS.
IRVIN VAN WIE, Prop.,
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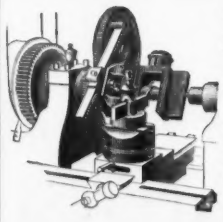
VERTICAL,
Horizontal & Suction Pumps.
Capacity 100 to 40,000 gals. per minute.
Sand Pumping Outfits a Specialty.

COATES' PATENT LATHE ATTACHMENT FOR TURNING CROSS-HEAD PINS.

This machine is new and has been thoroughly tested.
Actual tests show a saving of over $10.00 per day over old methods.
Can attach machine to or remove it from any ordinary engine lathe in five minutes.
An ordinary shop, in building engines, will save price of machine in 3 months' time.
An ordinary apprentice can operate machine perfectly well, and turn out first-class work.
Above features guaranteed.
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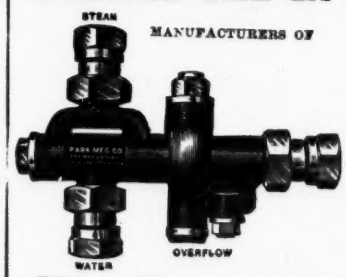

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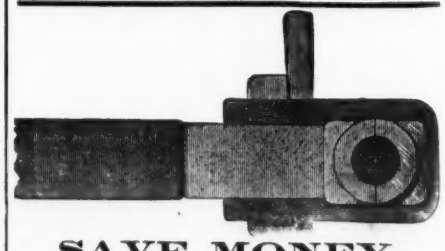
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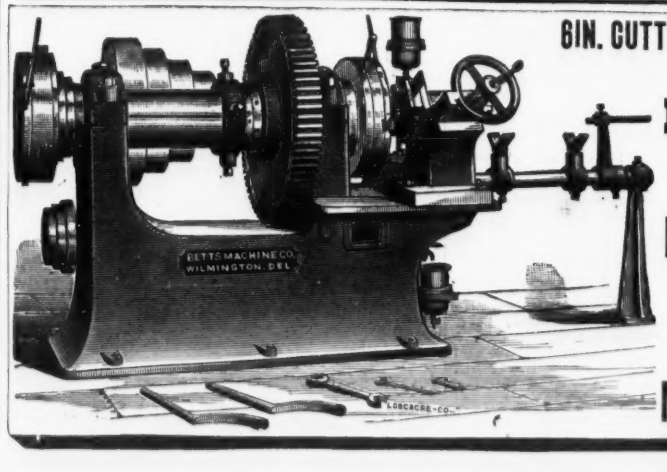

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BUILDERS OF
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Manufacturers of FILES and RASPS.

In Quantity, greater than
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In Reputation—No File sells so easily.

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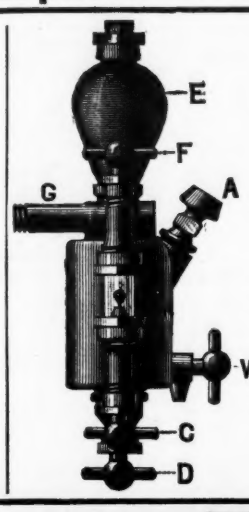

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For Stationary Engines and Pumps of all kinds. Lubricators for Single or Double Connection.

PRICE LIST.

Nos.	1	2	3
Price	$10.00	$12.00	$15.00
Capacity	½ pt.	½ pt.	¾ pt.

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Send for Catalogue. SOLE MANUFACTURERS.

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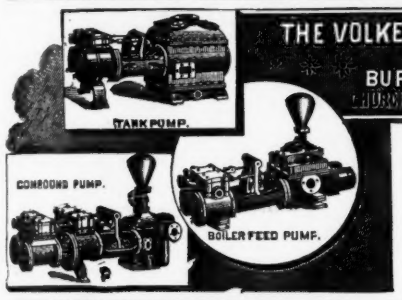

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To be driven from a Stud in the Face Plate.

No.	INCH.	PRICE.	No.	INCH.	PRICE
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2	⅞	.70	11	2½	1.45
3	1	.70	12	3	1.60
4	1⅛	.80	13	3½	1.80
5	1¼	.80	14	4	2.10
6	1⅜	.95	15	4½	2.75
7	1½	.95	16	5	3.25
8	1¾	1.10	17	5½	4.00
9	2	1.30	18	6	5.00
	1 Set to 2 in.	7.80		Full Set	31.10

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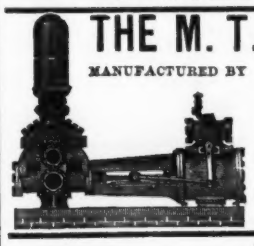

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Hall **Steam** **Duplex** **Pump.**

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I take great pleasure in announcing to you that the Hall Duplex Plunger Pump, bought from you Aug. 11, 1886, is working to my entire satisfaction, and I would cheerfully recommend the same to any one wanting a good pump.

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Dean Bros Steam Pump Works.
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Boiler Feeders, Duplex Pumps,
Fire Pumps, Send for Catalogue

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For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

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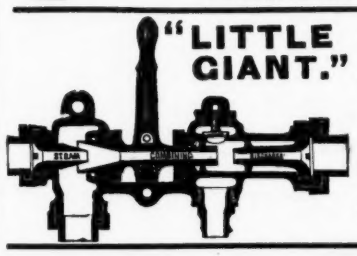

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For Feeding all Steam Boilers.

RUE'S EJECTOR,

Superior to all others for Raising and Forcing Water and other Liquids.

RUE M'F'G. CO., PHILA., PA.

CATALOGUES FREE.

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Force Blast Rotary Blower

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SLOW SPEED,
POSITIVE BLAST,
PERFECTLY BALANCED.

Best Mechanical Construction.

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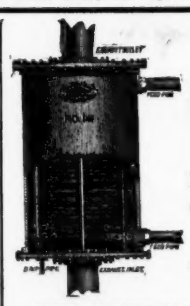

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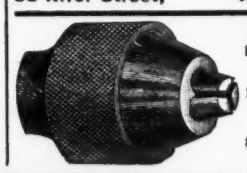

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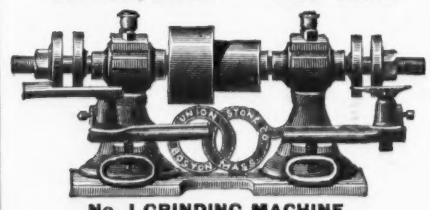

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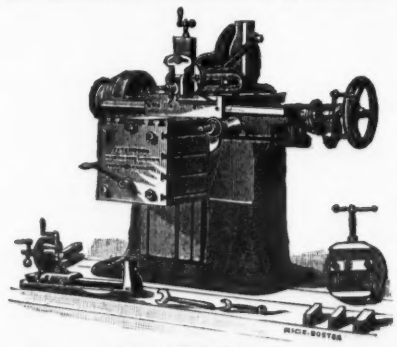

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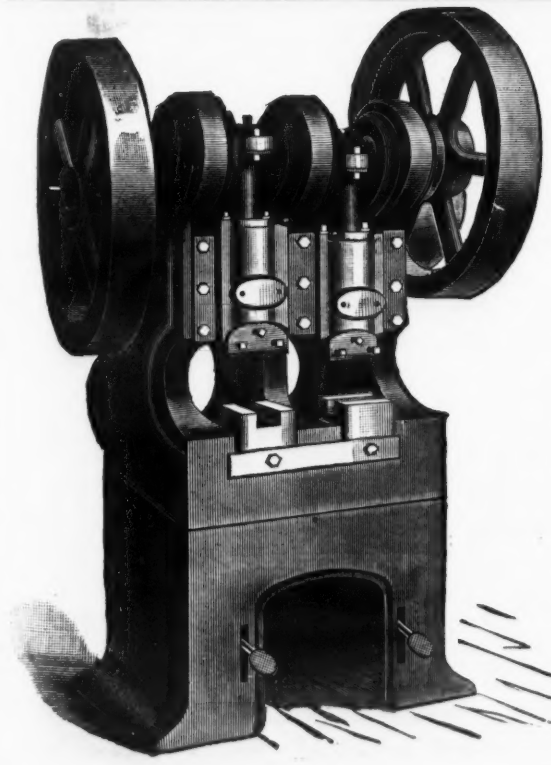

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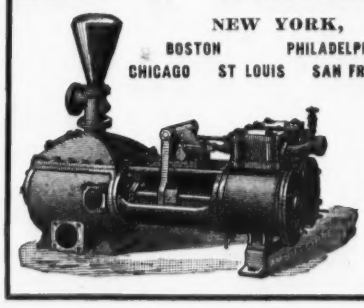

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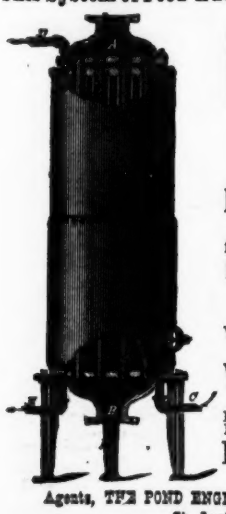

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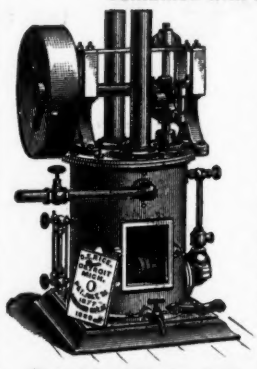

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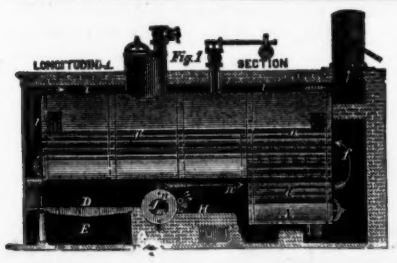

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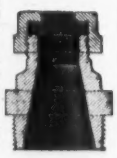

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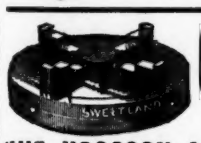

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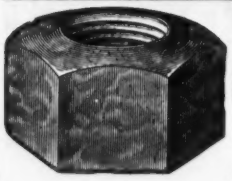

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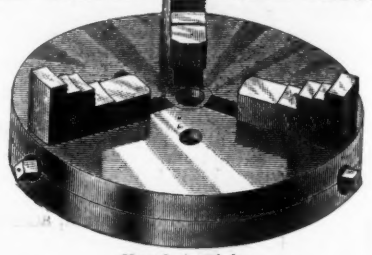

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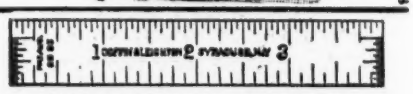

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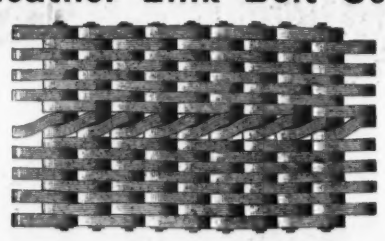

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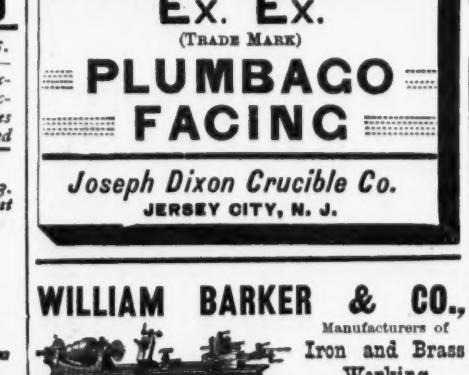

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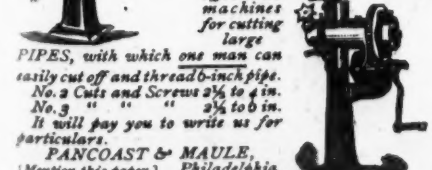

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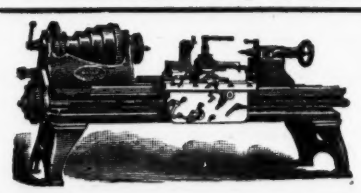

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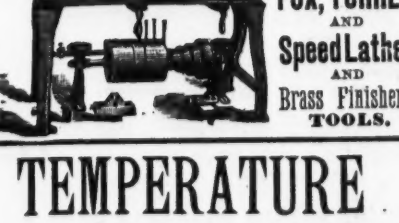

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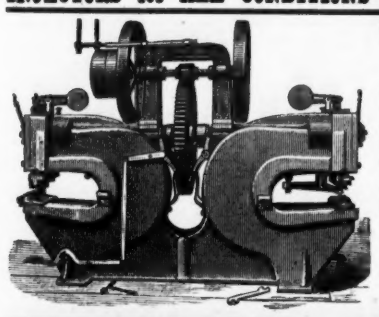

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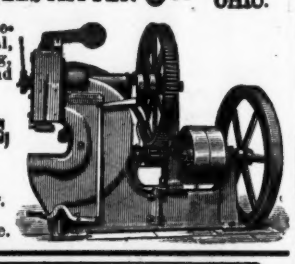

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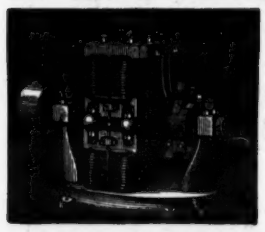

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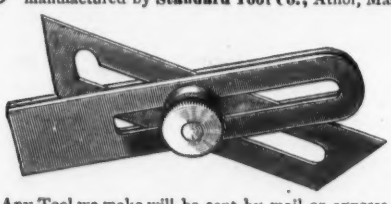

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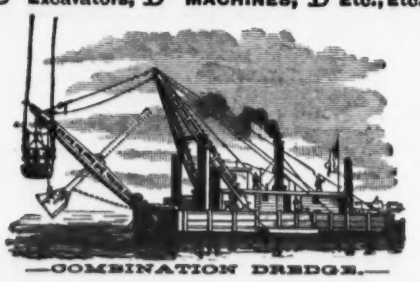

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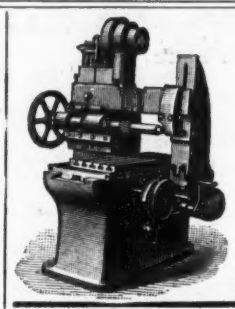

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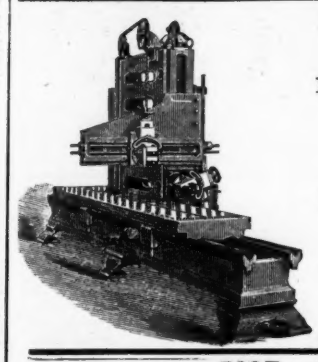

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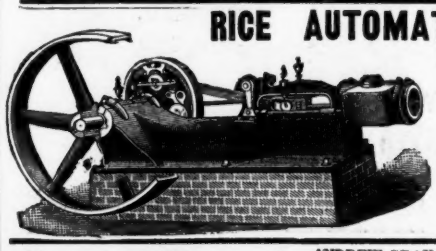

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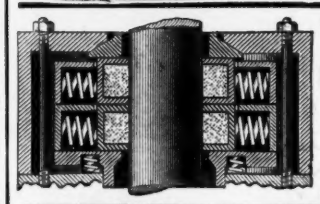

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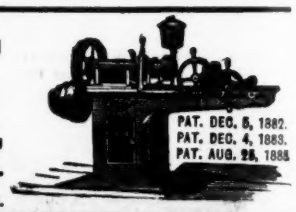

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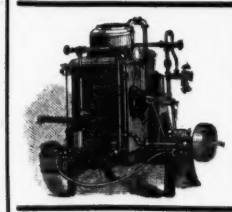

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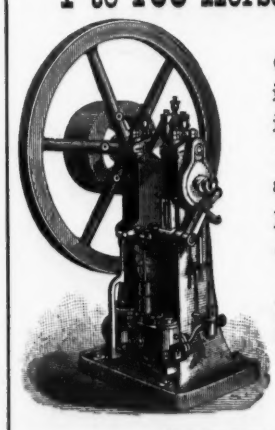

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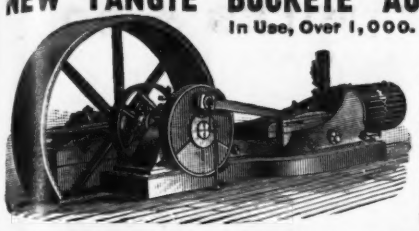

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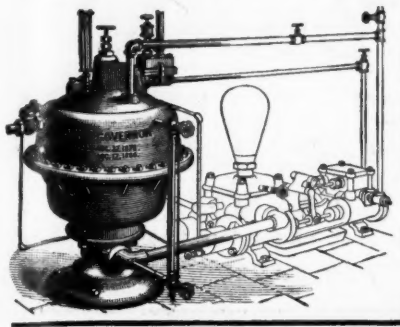

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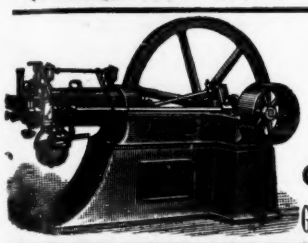

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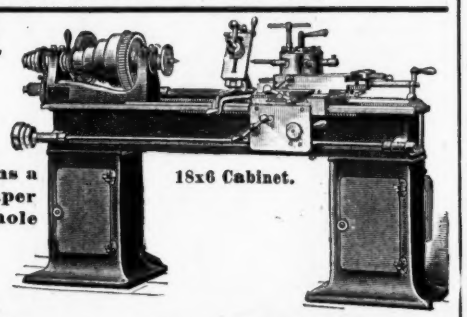

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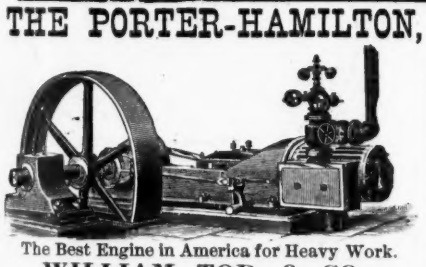

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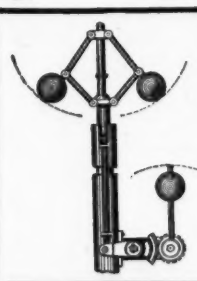

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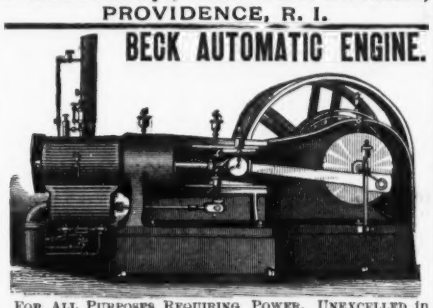

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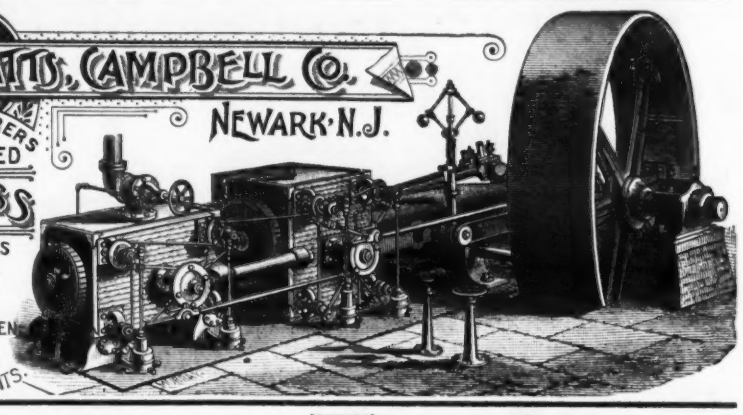

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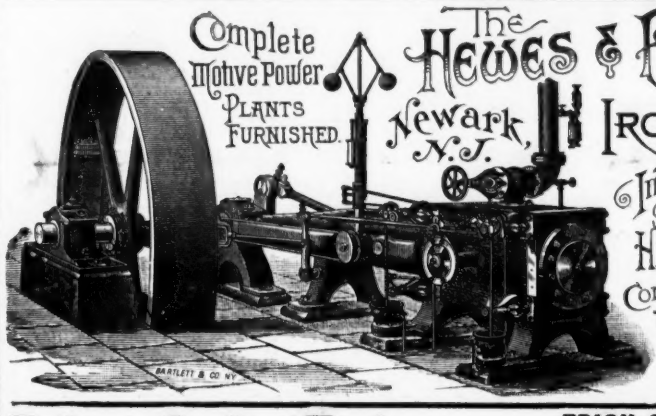

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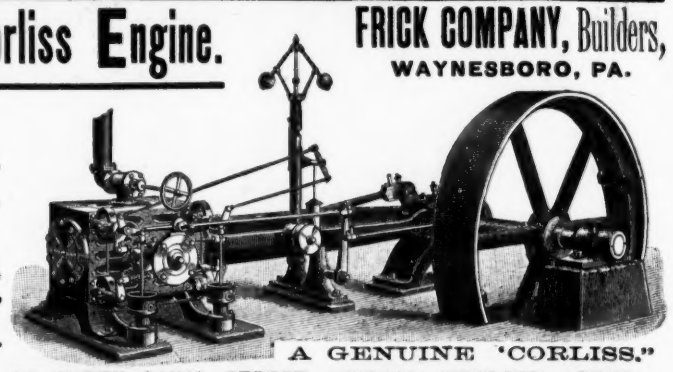

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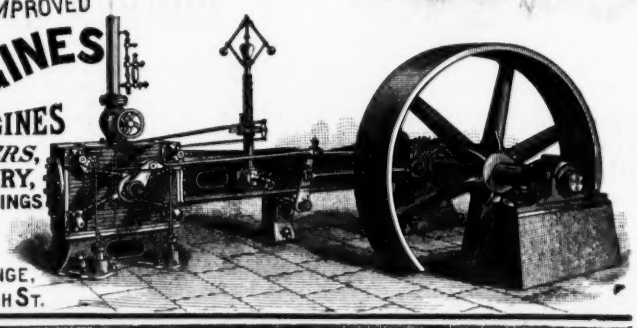

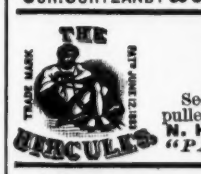

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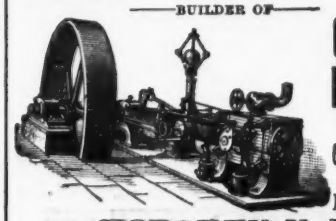

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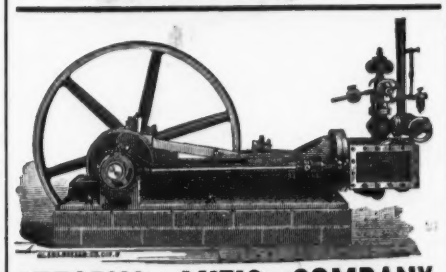

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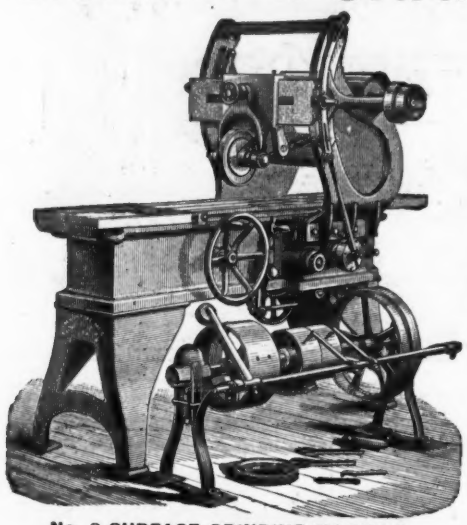

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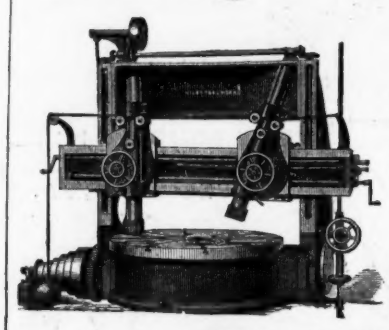

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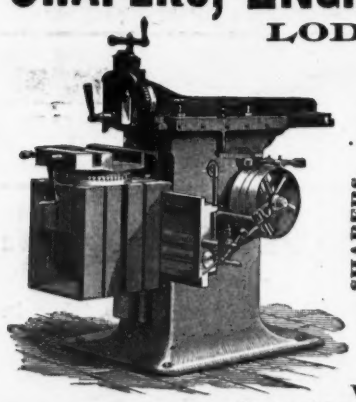

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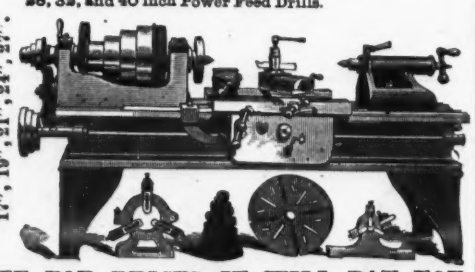

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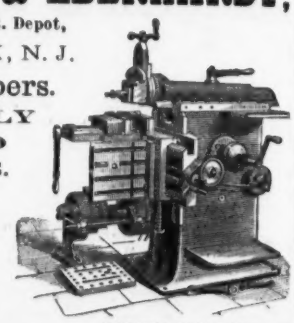

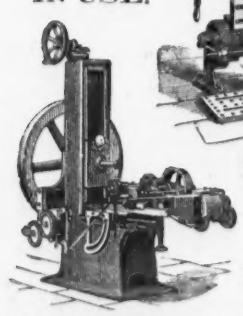

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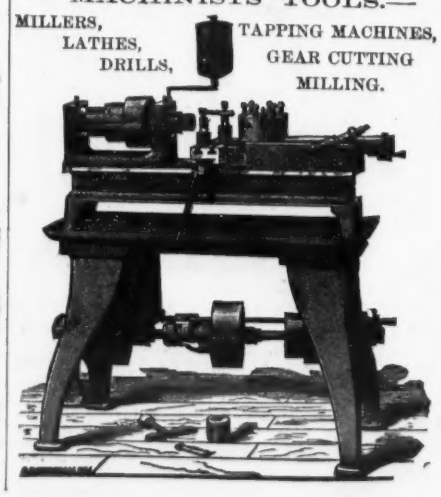

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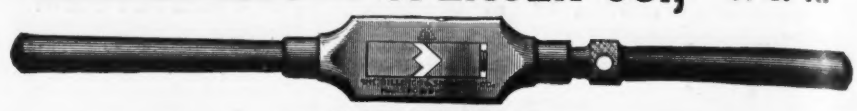

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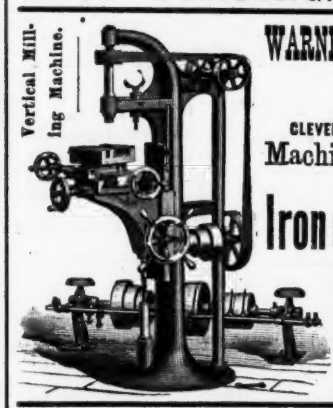

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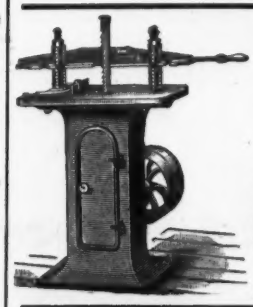

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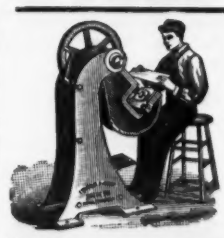

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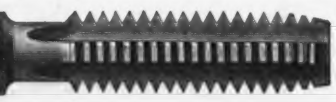

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